OFFICIAL PUBLICATION OF THE PROCEEDINGS AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

VOLUME 44, NO. 19
SEPTEMBER 12, 1955

AMERICAN

DYESTUFF REPORTER

Devoted to Textile Chemistry
BLEACHING · DYEING · PRINTING · FINISHING

TINOPAL RBNA

NEW ONE-STEP FLUORESCENT WHITENING AGENT FOR NYLON

Tinopal RBNA is resistant to bleaching agents such as chlorine and peracetic acid and can be applied simultaneously with the bleaching operation.

Tinopal RBNA is unaffected by normal scouring agents, even caustic soda, and can be applied while the material is being scoured — again eliminating a separate processing operation.

Applied at 140° to 160° F. from an alkaline or neutral bath, Tinopal RBNA has good exhausting properties and is level dyeing. Tinopal RBNA is especially recommended for filament nylon piece goods.

Tinopal RBNA has good resistance to high temperatures and can be used to offset yellowing from heat-setting, curing of melamine resin finishes and pleating processes.

Your Geigy representative has complete information on Tinopal RBNA.

"Tinopal" is a Geigy registered trademark.

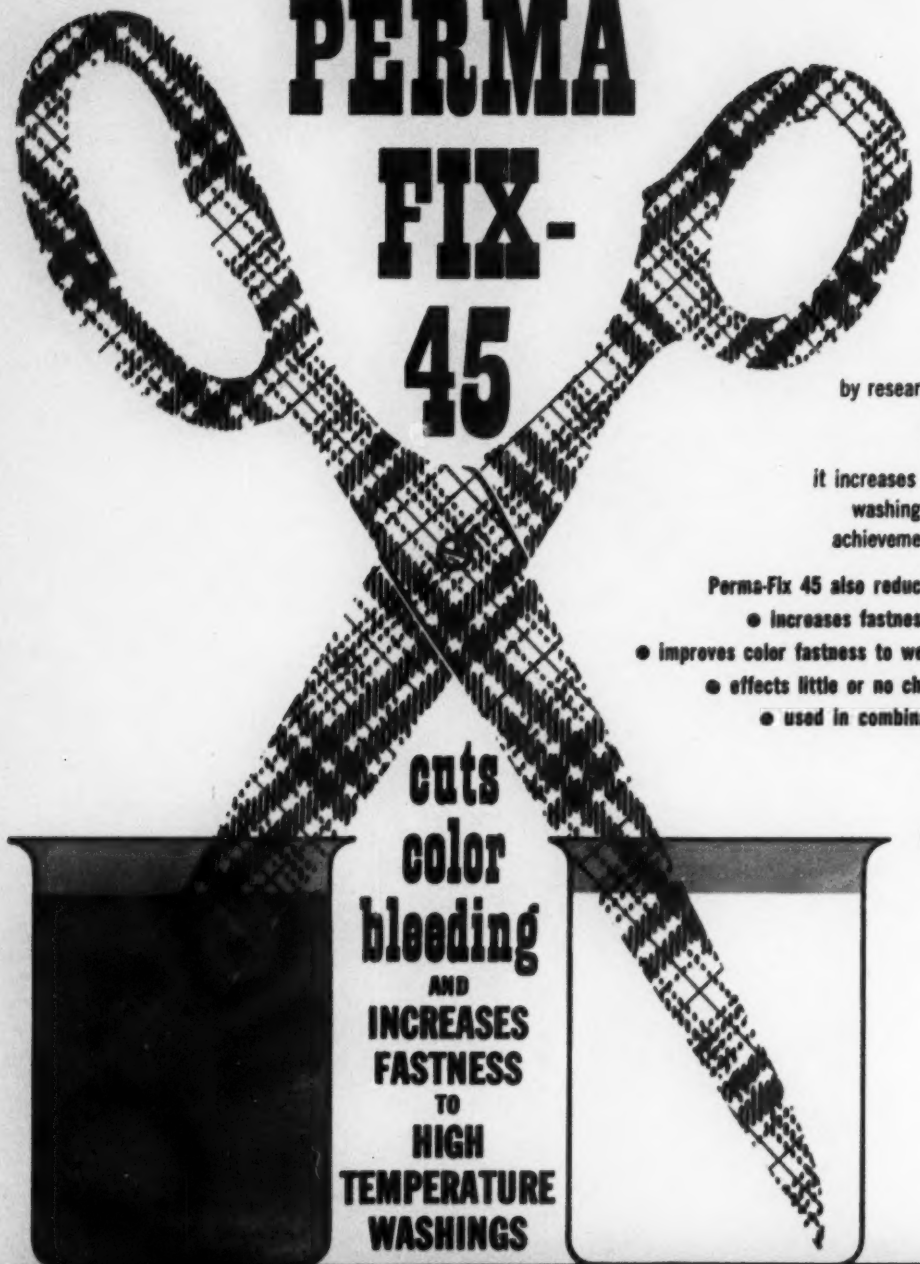
GEIGY DYESTUFFS
DIVISION OF GEIGY CHEMICAL CORPORATION
89-91 BARCLAY STREET, NEW YORK 8, NEW YORK

Geigy

dyestuff makers since 1859

BRANCH OFFICES: NEW ENGLAND: NEWTON UPPER FALLS, MASS. • CHARLOTTE, N. C. • CHICAGO • LOS ANGELES
PHILADELPHIA • PORTLAND, ORE. • TORONTO • IN GREAT BRITAIN: The Geigy Co., Ltd., Manchester

PERMA FIX-45



cuts color bleeding AND INCREASES FASTNESS TO HIGH TEMPERATURE WASHINGS

PERMA-FIX 45 developed by research has **proved by performance** its effectiveness in reducing color bleeding to a minimum, it increases fastness to high temperature washings. It represents a new high in achievement of fast colors on synthetics.

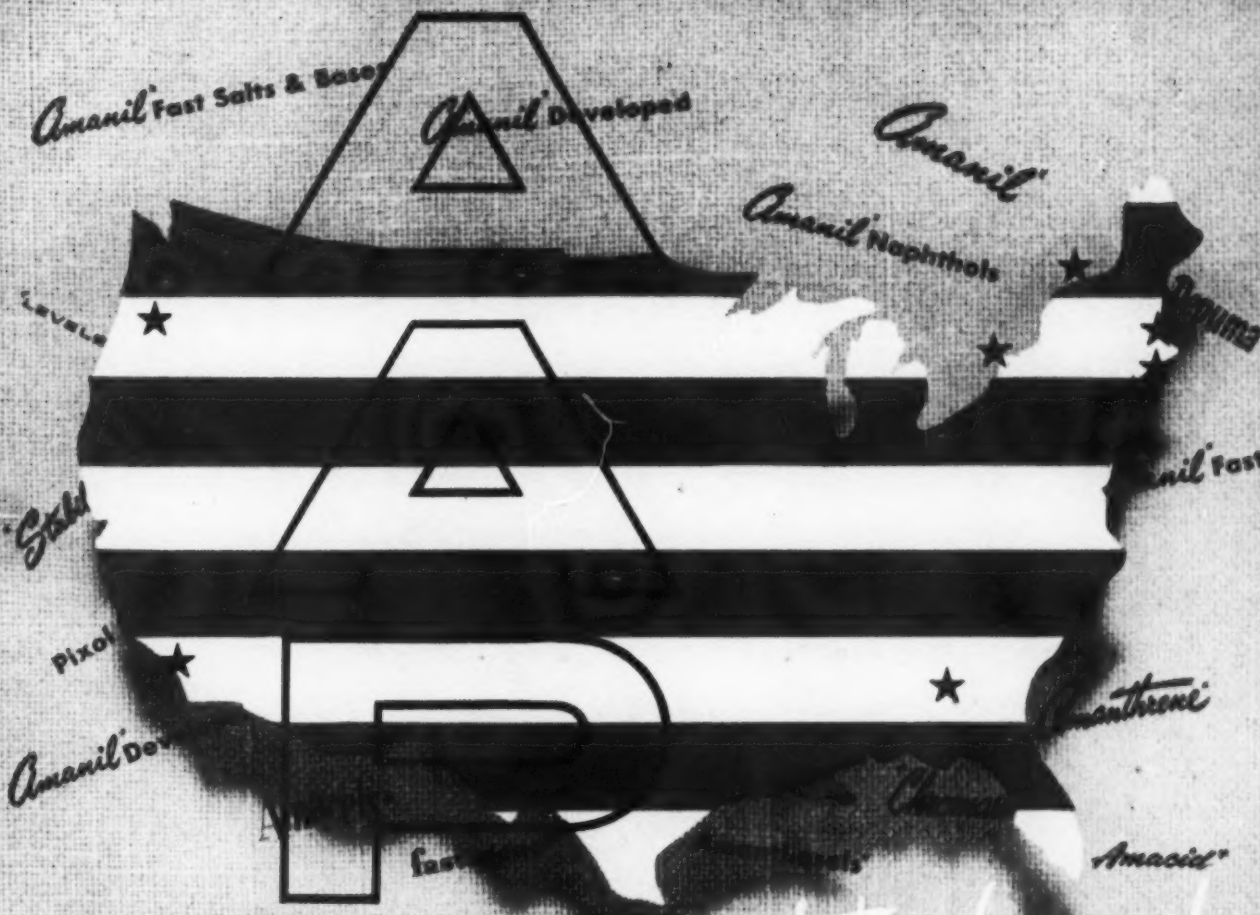
Perma-Fix 45 also reduces crocking —

- **increases fastness to washing and perspiration**
- **improves color fastness to wet-pressing and wet-processing**
- **effects little or no change in dyed yarns or fabrics**
- **used in combination with resins and finishes**

Dyers will like Perma Fix-45 for its **easy application — quality results — lower costs**

- **Technical Bulletin and Service available without obligation**

Refined PRODUCTS



pattern for service at the point-of-need

To serve its customers with maximum efficiency, A.A.P. maintains many strategically placed Branch Sales Offices, in addition to its home office in New York City and its 35-acre manufacturing works at Lock Haven, Pennsylvania.

Like the main office in New York City, each branch has its own warehousing facilities and complete application laboratories; thus, dyers, finishers, and printers in all textile centers are assured of convenient sources of supply, as well as prompt and expert assistance whenever special color problems arise.

Behind A.A.P.'s extensive facilities lie almost four decades of constant research and rigid manufacturing control. The benefits of this accumulated experience are yours for the asking. Technicians from our nearest branch will be happy to provide you, at any time, with full information on A.A.P. products and service.

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thermo-

Now we're manufacturing our own thermo-setting and thermo-plastic resins—right here in the South. We're turning out a dynamic series of resins varying from one extreme to the other in hand, durability and thermal behavior.

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We're proud of what's coming out of this plant, and you will be, too. We are meeting head-on the changing trends in new fibers, creating the tools that will help you chalk up new developments in a tight industry.

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Don't have to tell you what our WICA resins will do to boost the value of your tags. Customer faith in those tags is like money in the bank. Wica Chemicals, Inc., Old Concord Road, Charlotte, N. C.

by WICA

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Alcian Blue
Here is a truly exclusive color . . . only Arnold, Hoffman can offer you the completely unique advantages of exciting ALCIAN BLUE!
You can dye ALCIAN BLUE on cotton piece goods or yarn in packages and you can print this fabulous color on cottons . . . Ahco technical demonstrators are available to assist you in application techniques.
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DYES

From TOP to bottom... it's Mutual for Bichromates

Sodium Chromate

Sodium Bichromate

Chromic Acid

Potassium Bichromate

Whether the formula calls for Top Chrome or Bottom Chrome, experienced dyers of wool prefer Mutual Bichromates. The Mutual trademark, oldest in the industry, has been regarded as the hallmark of quality for many years.

Mutual Bichromates of Sodium and Potassium are bright, clear crystals assaying over 99% pure. These dissolve readily to form solutions of exceptional clarity.

These same Bichromates also find extensive use in oxidizing vat dyes or sulfur colors where their outstanding properties again cause them to be preferred.

Mutual Bichromates are shipped directly from Mutual plants or from distributors' warehouses throughout the United States and Canada.

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MUTUAL — ALLIED CHEMICAL & DYE CORPORATION

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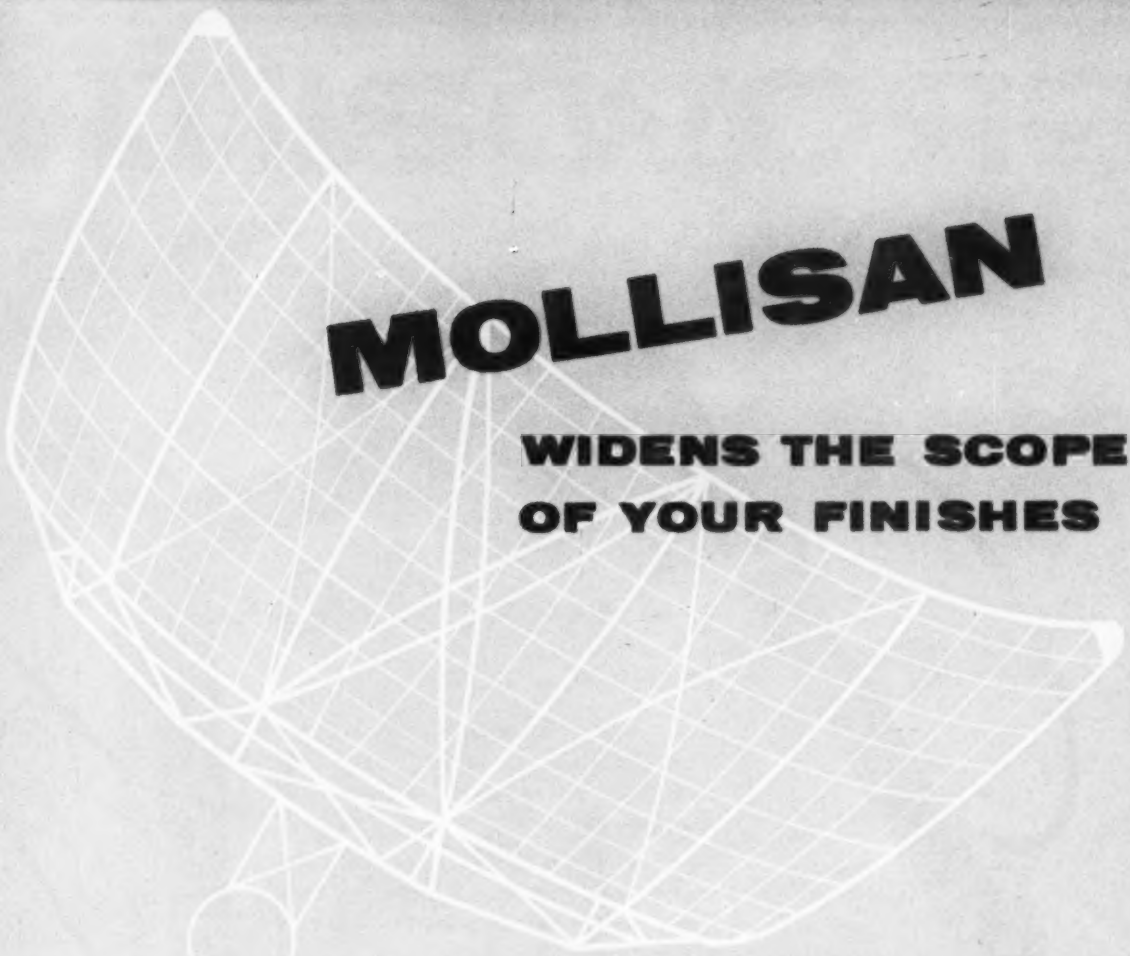

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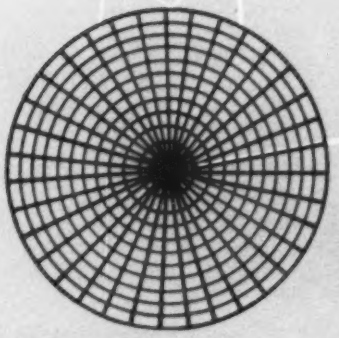
New textile lubricant and softener strengthens resin-finished fabrics; effective anti-static agent for synthetics

Unusual in its versatility and effectiveness as a non-ionic lubricant and softener, MOLLISAN offers an extraordinarily wide range of highly advantageous textile finishing applications.

MOLLISAN-treated fabrics are outstanding in their resistance to yellowing and resin embrittlement at even the highest temperatures. MOLLISAN greatly increases tear and abrasion resistance, sewability, hand and appearance in resin-treated fabrics. With synthetics, it has proven itself an exceptionally effective anti-static agent.

Add it all up and you will find you cannot afford to ignore the potential MOLLISAN holds for your sales and profits. Call for full information, and working samples – today.



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In our chemical division we're as fond of new business as anyone. But we like to create it. By working with you and developing chemicals to accomplish your purposes.

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*Avisco is the trademark of American Viscose Corporation

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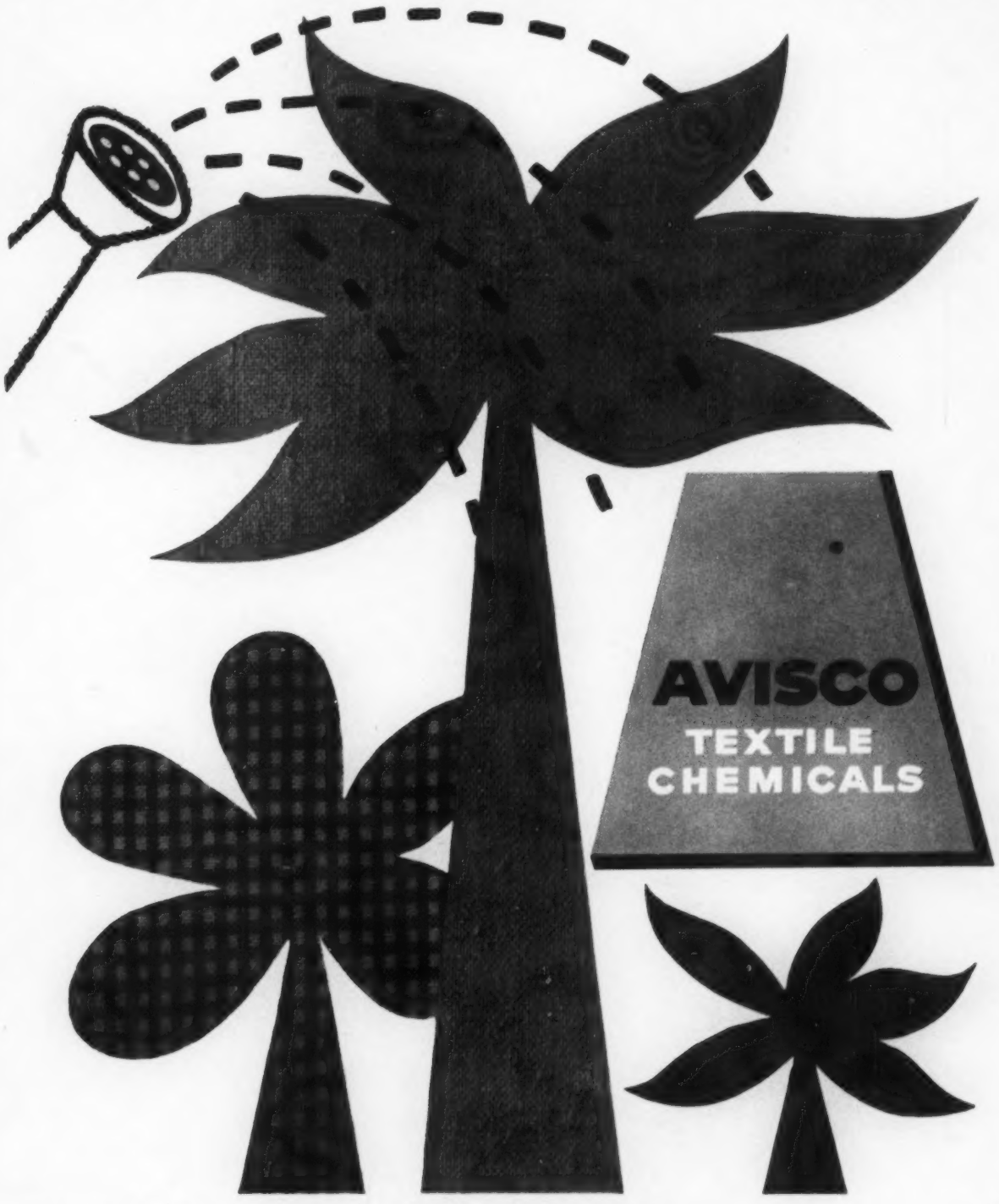


To Insure LEVEL DYEING ...Add NOPCO 1425-B

AND SUBTRACT 15% ~~to 85%~~ FROM YOUR COST!

No more streaky shades! From now on, you can count on turning out *uniformly* the exact shades you have chosen.

You can use Nopco 1425-B in either of two ways to get this result:

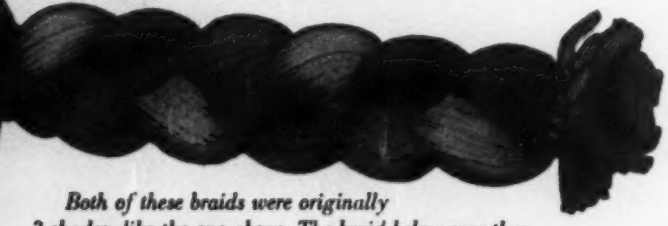
As a preventive. By adding a very small amount (0.25% to 1%) of Nopco 1425-B to the dyebath, you promote level dyeing by controlling the rate of dye absorption by the fiber. This of course is the preferred method.

As a corrective. Somewhat larger amounts (2% to 5%) of Nopco 1425-B may be used to correct streaky or overdyed shades.

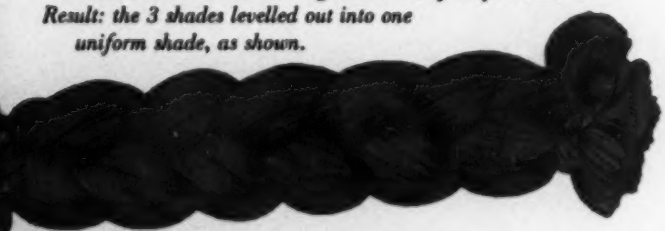
NOPCO 1425-B OFFERS THESE ADVANTAGES:

1. More economical. It levels the dyeing instead of resorting to expensive chemical stripping and then re-dyeing.
2. Preserves tensile strength; is non-felting.
3. Does not require re-dyeing—merely re-shading in same bath.
4. Eliminates any danger of machine corrosion.
5. Results in greater leveling and stripping of colors, and the resulting bottom shade is generally cleaner than that obtained from chemical stripping.

In addition to the *big* savings here, resulting from the elimination of stripping and re-dyeing, there is the further striking fact that Nopco 1425-B costs from 15% to 85% less per pound of active material than any other product that does a comparable job.



Both of these braids were originally 3 shades, like the one above. The braid below was then treated in a bath containing about 4% of Nopco 1425-B. Result: the 3 shades levelled out into one uniform shade, as shown.



You'll want to know more about Nopco 1425-B— and a Nopco representative will gladly work with you to obtain best results. Write today.

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for colors *truly fast*—by *your* standards—

INDANTHRENE® VAT DYES

Whatever the use for the fabrics you dye or print—for clothing, upholstery, draperies, floor coverings, awnings, etc.—the unavoidable demand is that they shall be fast-to-light, fast-to-washing. Your customer's business is safeguarded, when you use vat colors... Indanthrene Vat Dyes have been the standard of the industry for more than 50 years.

From a single source, you draw on the widest color range available. Moreover, to be certain of meeting any requirement you establish, these colors are standardized in as many as six different physical forms...

- "WF" brands—dispersible powders for pigment padding and package dyeing
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Consider the strategic location of our warehouses and laboratories to meet your immediate needs. Call upon our Technical Service Department for assistance in any color or color-matching problem. We invite your inquiry.

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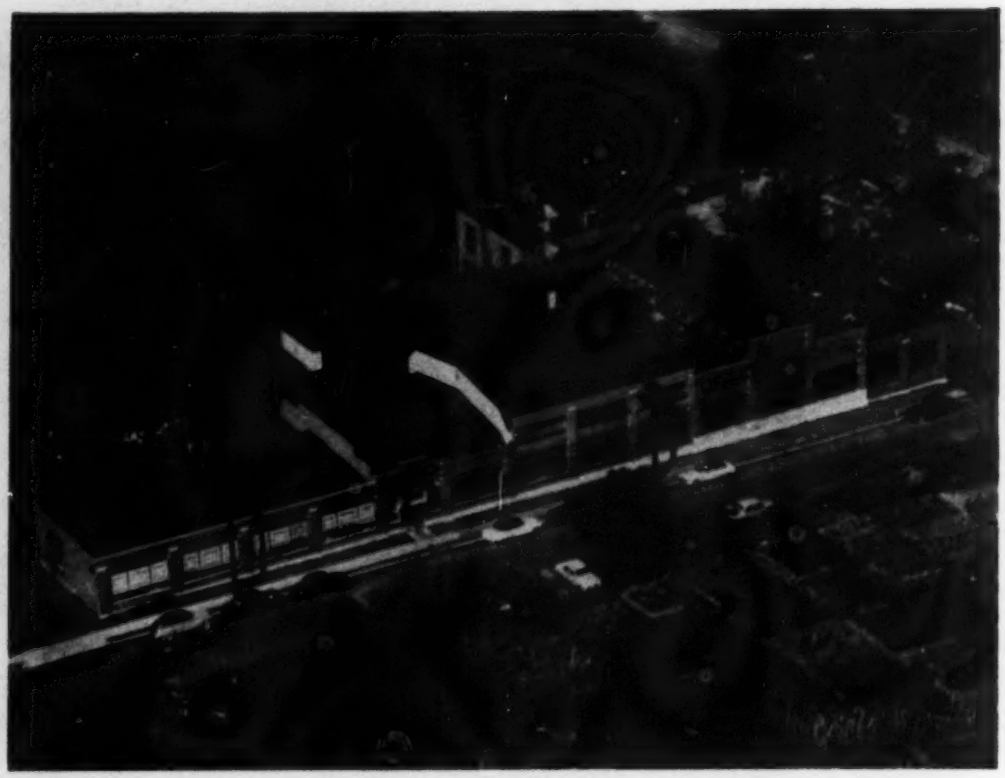
BICK & CO., INC.

Pioneer In American Dyes



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BICK CHEMICAL CORPORATION

(Successor)

greets A. A. T. C. C. and pledges to keep pace with advances of American Textile Chemistry.

Du Pont develops high-temperature piece-dyeing methods for new synthetic fibers...

brings you a full range of fast colors at less cost!

DU PONT RESEARCH led the way to high-temperature (250°F.) stock dyeing of the newer hydrophobic fibers. Extending this principle of high-temperature application to piece dyeing — to achieve the same excellent fastness and color build-up obtained in stock dyeing — presented equipment problems.

Du Pont technicians went to work to adapt high-temperature methods to piece dyeing. One result was the Barotor, such as this one. It is operated at the Waldrich Company in Delawanna, New Jersey, where excellent results have been obtained.

While developing new methods, Du Pont also introduced "LATYL"‡ dyes for "Dacron"* and "SEVRON"‡ dyes for "Orlon"† acrylic fibers — dyes with excellent light and wet fastness. The combination of these new dyes and high-temperature dyeing results in high-quality dyeings in a full range of deep shades.

Du Pont will be glad to give you the latest information on high-temperature dyeing. Just contact your Du Pont representative or write to E. I. du Pont de Nemours & Co. (Inc.), Dyes and Chemicals Division, Wilmington 98, Delaware.

DISTRICT OFFICES—Atlanta, Georgia; Charlotte, N. C.; Chicago, Illinois; Los Angeles, Calif.; Rumford, R. I.; New York, N. Y.; Philadelphia, Penna.

In Canada: Du Pont Company of Canada Limited, Montreal, Quebec

Improved results with high-temperature piece dyeing:

for **NYLON** – shades are uniform from run to run, have outstanding fastness.

for **"DACRON"** – need for a chemical carrier is eliminated, which cuts costs. Color build-up is excellent, giving deep, bright colors with no spotting or streaking, no loss of light fastness.

for **"ORLON"** – shade build-up is more efficient, cutting down on dyeing cycle and giving popular deep shades not attainable by any other method. Dyer also gets full fastness values from the Du Pont "SEVRON" dyes.

‡Reg. U. S. Pat. Off.
*"Dacron" is Du Pont's registered trade-mark for its polyester fiber
†"Orlon" is Du Pont's registered trade-mark for its acrylic fiber

Du Pont Dyes

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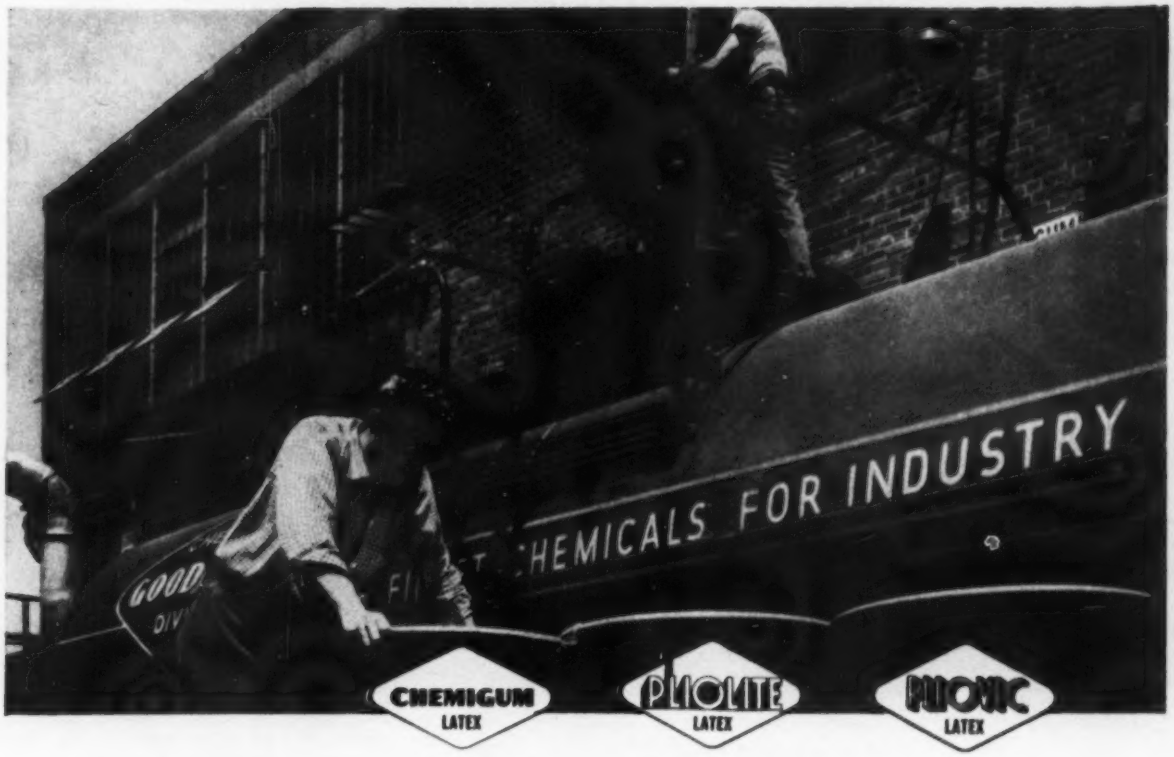
BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*



"LIQUID ASSETS" FOR YOU?

COULD BE! Goodyear latices in the form of improved finishes, sizes, saturants, adhesives and pigment vehicles are proving "liquid assets" to many textile manufacturers.

Goodyear produces a number of these aqueous dispersions of synthetic rubbers and resins. They are available in three basic types and in a range of monomer ratios, solids contents, particle sizes and types of stabilization to give you a wide choice of physical properties and processing characteristics.

Lasting improvements in body, drape, dimensional stability and strength plus increased resistance to washing, wear, wrinkling, raveling, tearing, snagging and sliding—all these are possibilities with Goodyear latices. They can be used alone, in combination with each other or as modifiers of your present materials. And you'll find they process easily on standard equipment.

Full details, samples and technical help on latices by Goodyear—an old hand with these new materials—are yours by writing:

Goodyear, Chemical Division, Akron 16, Ohio

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Can These Latices Be "Liquid Assets" For You?

CHEMIGUM LATICES— oil-resistant, butadiene-acrylonitrile copolymers – medium to high nitrile content – high solids content – range of particle sizes – three types of stabilization

PLIOLITE LATICES— general purpose, butadiene-styrene copolymers – medium to high styrene content – low to high solids content – "hot" and "cold" types

PLIOVIC LATICES— vinyl copolymers – high vinyl content – high solids content

Chemigum, Pliobond, Plioflex, Pliolite, Plio-Tuf, Pliovic—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

The Finest Chemicals for Industry—CHEMIGUM · PLIOBOND · PLIOFLEX · PLIOLITE · PLIO-TUF · PLIOVIC · WING-CHEMICALS

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makes textile processing

easier, better *and* more efficient

Calgon has many uses in the Textile Industry. In almost every phase of textile processing, Calgon can lend a hand to speed, or make more effective, the work being done.

Calgon experts stand ready to assist you with special problems. A letter or phone call will put years of experience with every phase of the Textile Industry at your disposal.

calgon, inc.

A SUBSIDIARY OF HAGAN CORPORATION
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Check this list of a few of the many ways Calgon can speed up production

CALGON CONDITIONS WATER

Softens more water for less money

Calgon not only softens water until it is as soft as distilled water, but acts as a solvent for lime soap as well.

CALGON IN SCOURING OR RINSE BATHS

No more lime soap curds

Calgon supplements the detergent action of soaps and synthetic detergents. Calgon corrects the only fault of soap—that of precipitation in hard water.

CALGON IN THE DYEBATH

Gets brighter, more uniform colors and reduces scum

Calgon exerts a dispersive and solubilizing action on many dyestuffs, and acts as a leveling and penetrating agent. You get more vivid and more even colors.

CALGON DISPERSES PIGMENTS

for smoother, more even finishes

Calgon is an excellent dispersing agent for clay, calcium carbonate, titanium dioxide and other pigments. Calgon is particularly effective for uniform finishing of rayon.

PIGMENTED RAYON

Calgon aids penetration

Calgon assists the penetration of dyes in pigmented rayon, giving deeper and brighter shades. Calgon stops scum formation, assuring more even colors.

THRESHOLD TREATMENT FOR CORROSION CONTROL*

Eliminates iron, reduces off shades and lowers chemical cost of bleaching

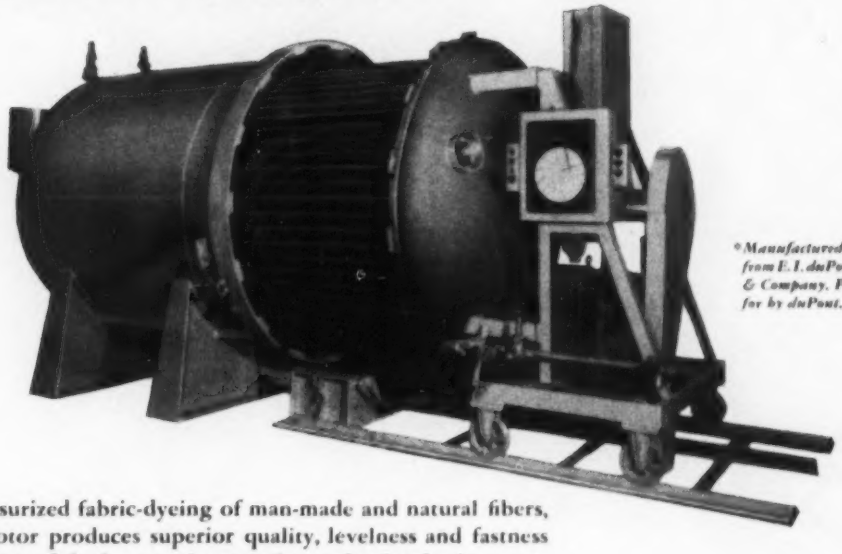
Calgon prevents the contamination of process water from iron corrosion products. Using very small quantities of Calgon, Threshold Treatment is the most economical method for elimination of iron contamination.

*Fully licensed for this use under U.S. Patent No. 2,337,856.

Write for your free copy of "Calgon Data for the Textile Chemist"

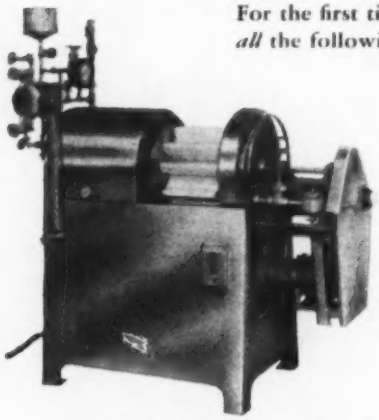
WIESNER-RAPP
BAROTOR*

. . . for Pressure-Dyeing Fabrics



*Manufactured under license from E. I. duPont deNemours & Company. Patent applied for by duPont.

Ideal for pressurized fabric-dyeing of man-made and natural fibers, this new Barotor produces superior quality, levelness and fastness in the full range of shades on a large-scale production basis.



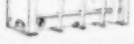
LAB SIZE BAROTOR has all the basic features of the large production model Barotor. It is functionally designed for use in test dyeing to accurately predetermine large scale production results and also for laboratory use in dye and process development.

For the first time, this newly developed dyeing machine incorporates *all* the following 12 important features for superior dyeing:

- Fabrics open width at all times.
- Tensionless.
- All points in uniform and frequent bath contact.
- Rapid bath circulation and agitation.
- Operable with all woven fabric construction, both filament and spun.
- Widely adaptable for batch size.
- Have no need for attention during dyeing.
- Excellent duplication of conditions between laboratory and production scale.
- Fabric sampling and bath additions made without opening vessel and losing pressure, time or heat.
- Samples representative of the entire fabric.
- Cylindrical shape with maximum utilization of dyeing space.
- Investment commensurate with productivity in comparison with atmospheric dyeing.

In addition, *the patented quick opening door,* an exclusive Wiesner-Rapp feature, greatly reduces the dyeing cycle time. Write today for complete information.

OTHER WIESNER-RAPP MACHINES



TIGHT-STRAND WASHER

MULTI-STAGE WASHER

DYE BECK

3-ROLL PADDER

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1612 SENECA ST., BUFFALO 10, N. Y.
Manufacturers of Textile Finishing Machinery

print paste thickener of highest viscosity

KELTONE, an extra high viscosity Kelco product for textile printing, gives top quality performance at substantially reduced costs. With **KELTONE** you prepare your print paste thickener to any desired viscosity, yet you use appreciably lower gum concentrations.

You can rely on **KELTONE**'s high viscosity shipment-after-shipment, for **KELTONE** is precisely engineered and manufactured to absolutely uniform standards.

Important, too, is the fact that **KELTONE** is domestically produced, which means better dependability in your source of supply week-in and week-out, year-in and year-out.

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NOW! a New Low Cost, Low Calcium Brine!

Available in Bags and Bulk

● Saves money on sequestering agents! ● Eliminates streaks and off-shading! ● Increases color intensity!

MORTON "PCB" is a new, patented rock salt product. It contains southern rock salt, plus special chemical compounds in pelletized form to give a controlled dissolving rate. The purpose of this combination is to keep harmful calcium deposits from going into solution, and thus eliminate them from the brine.

As the chart below shows, "PCB" Rock Salt brine contains approximately 80% *less calcium* than brine made with untreated rock salt. (The less than 200 PPM calcium in "PCB" brine will not precipitate.) What's more, "PCB" can be used in your present rock salt dissolving equipment without additional construction or extra labor.

"PCB" is specifically recommended when brine is used in dyeing rawstock, package, beam, beck or jig with either sulphur, direct or naphthol dyes. ("PCB" brine also can be used effectively in your water softener.)

ORDINARY ROCK SALT BRINE AVERAGES 800 PPM

PCB ROCK SALT BRINE AVERAGES 200 PPM

PPM Calcium in Brine

Brine made from ordinary rock salt contains approximately 4 times more calcium than brine made with new "PCB".

"PCB" Brine

• Improves crock fastness with naphthol dyes • Increases color intensity where sulphur dyes are used • Results in softer finishes, more even shades • Saves money on sequestering agents • Aids in retarding corrosion • Is far less expensive than brine produced from purified low calcium evaporated salt.

FREE! Let a Morton Brine Engineer take a sample of your brine. He'll have it analyzed in Morton's laboratory and tell you how much you can reduce the calcium content by using "PCB" Salt.

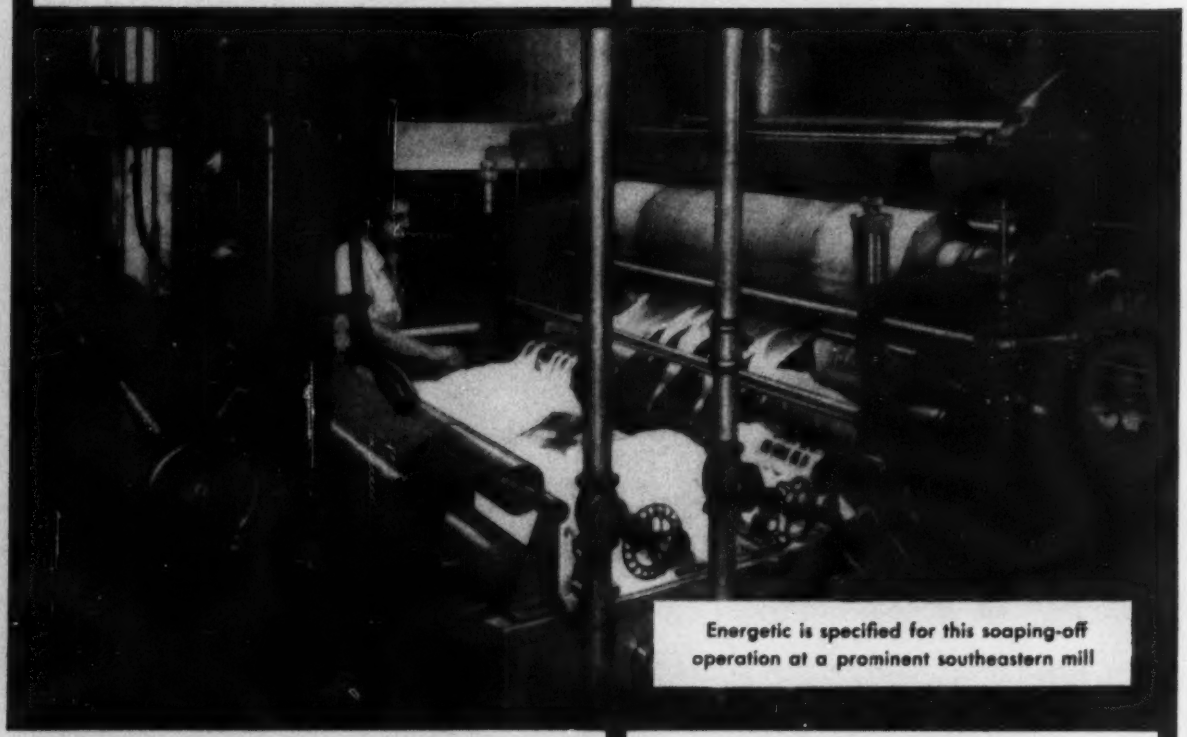
MORTON SALT COMPANY
Industrial Division, Dept AD-9
120 S. LaSalle Street, Chicago, Illinois

☐ Please send me your free booklet on "PCB."
☐ I would also like a Morton Brine Engineer to make an analysis of the brine in my plant.

Name_____
Title_____
Company_____
Address_____
City_____ State_____

Armour Energetic* pays off where you soap-off...

with sharper, clearer prints!



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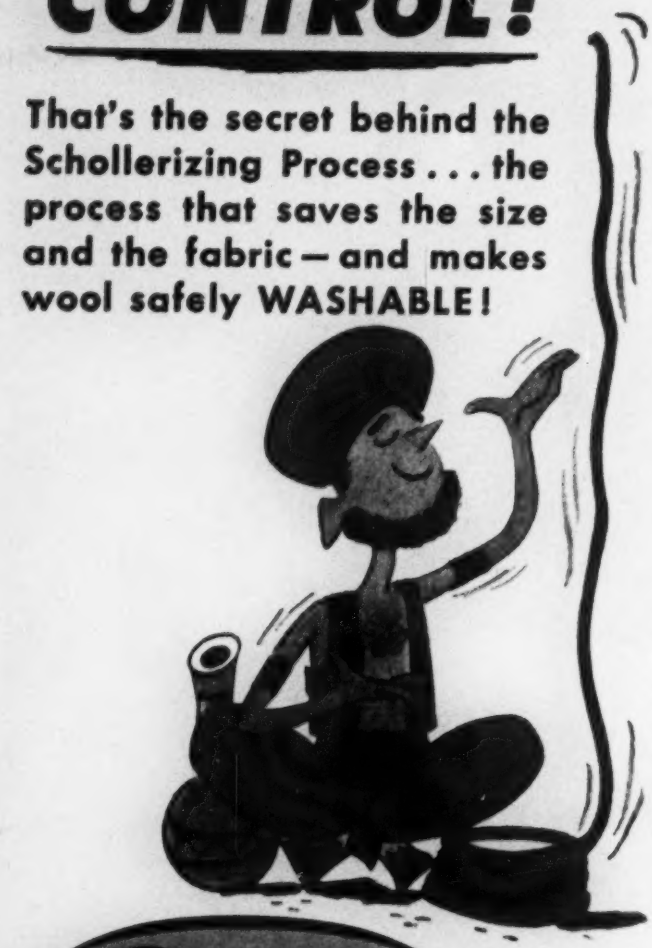

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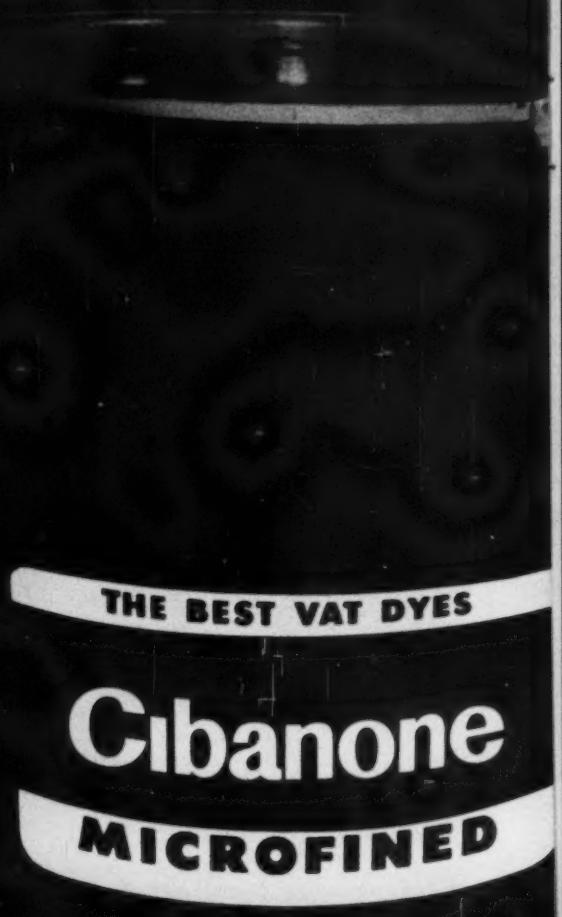

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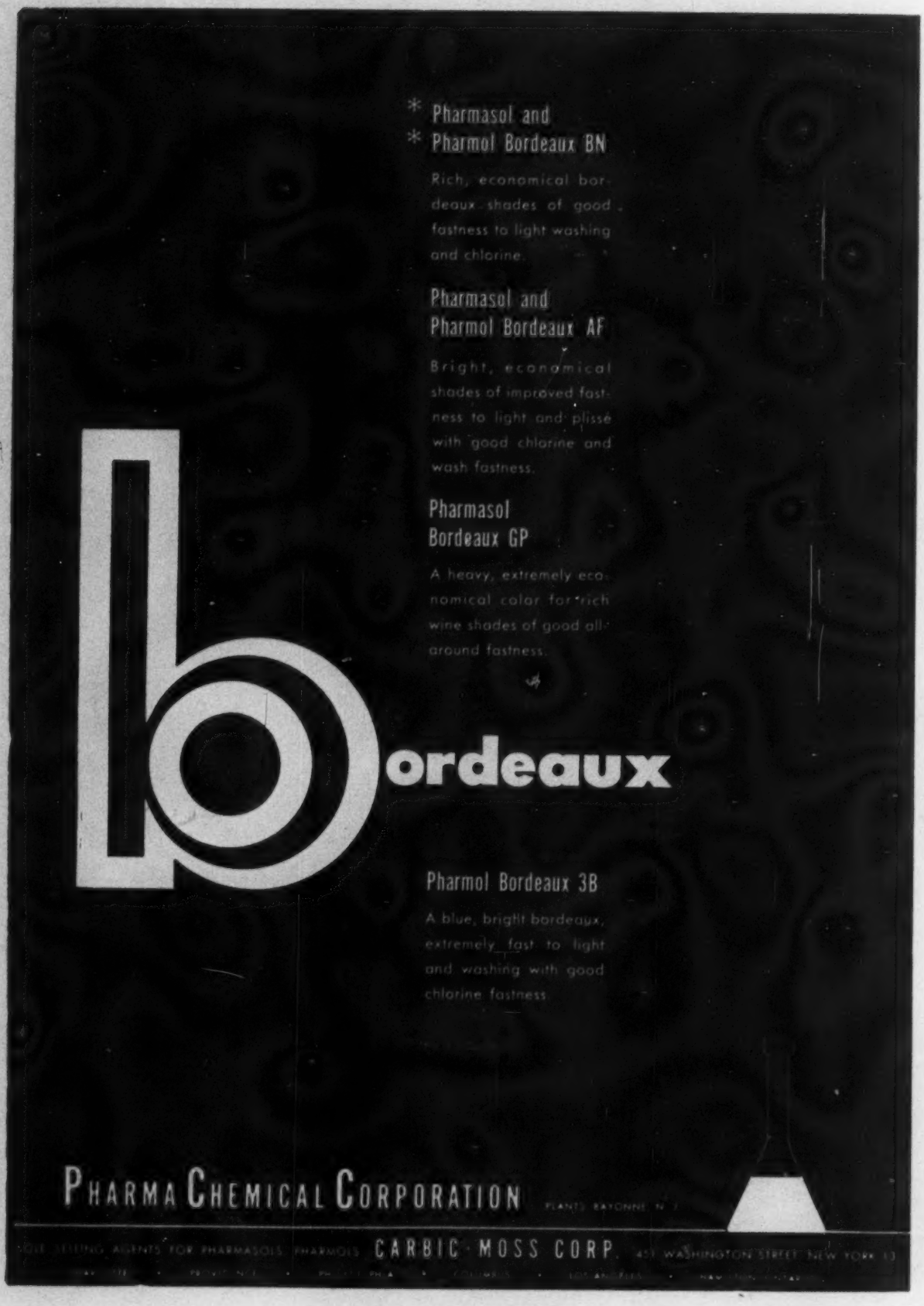
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VOLUME 44 SEPTEMBER 12, 1955 NUMBER 19

DISTRIBUTION OF PHOSPHORUS DURING PROCESSING AND CHARRING OF THPC-RESIN-TREATED COTTON FABRIC

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New Orleans, Louisiana

INTRODUCTION

INCREASING interest is being shown in flame-resistant finishes for textiles, not only from the standpoint of military uses, but for certain civilian uses as well. One of the promising permanent-type flame-resistant treatments for textiles developed at this Laboratory *(6, 7, 8)* is the THPC-resin treatment. In addition to imparting flame-resistance, this treatment also improves a fabric's wrinkle-, rot-, and mildew-resistance.

In view of the general interest in the THPC process, and because of the important role of phosphorus in the process, it was deemed advisable to investigate the distribution of phosphorus during laboratory-scale processing and charring of a typical THPC-resin-treated cotton fabric (8-oz khaki twill). Although the amount of resin "add-on" and the curing conditions during processing need to be varied according to the type of fabric and degree of flame resistance required *(6, 7)*, phosphorus distribution information on the fabric selected should indicate trends to be expected for other types of fabrics.

The present experiments were designed so that three broad classes of phosphorus compounds, evolved during drying, curing, and charring, could be separated and determined. One of these classes should consist predominantly of phosphine (PH_3), which is of considerable interest and importance because of its toxic nature. This gas is liquefiable at a temperature of −90°C *(3)*, whereas the other types of phosphorus compounds that would probably be evolved are condensable at considerably higher temperatures. This, together with the fact that phosphine can be absorbed and oxidized by bromine water *(1)*, forms the basis of the separation scheme employed.

EXPERIMENTAL

PROCESSING OF THPC-FABRIC ——In order to investigate the distribution of phosphorus during the drying, curing, and washing steps of the THPC process, a typical resin-forming flameproofing solution *(7)* was prepared. It contained 16.65% of a commercial sample of THPC [tetrakis-(hydroxymethyl)phosphonium chloride. . . . $(HOCH_2)_4PCl$], 3.01% triethanolamine, 9.53% trimethylolmelamine, 9.93% urea and 60.88% water. This solution contained 2.44% phosphorus, as determined by a wet digestion - reduced molybdate colorimetric method *(5)*.

A weighed 6-inch square of 8-oz khaki twill was padded with the solution twice, using a very tight squeeze-roll setting each time. The wet pickup was 67.77%. Upon re-analysis of the treating solution, a value of 2.46% phosphorus was obtained, indicating that there was no selective adsorption.

The "wet" fabric was dried and cured in an all-glass apparatus, which was mounted in an electric oven maintained at the desired drying or curing temperature. The fabric sample was rolled around a glass tube carrier (approximately 1" diameter x 6" length), which was then inserted into a tubular glass vessel (approx 1½" diameter x 11" overall length). The latter vessel had a ground glass joint at one end to permit insertion of the fabric and carrier, and an outlet tube at the other end extending through the hole in the top of the oven for connecting to the absorption train used to trap the evolved phosphorus compounds. The absorption train consisted of one trap maintained at 0° to —5°C by means of an ice-salt bath, two traps maintained at −65°C by means of dry ice-acetone baths, and three traps containing 40 ml of saturated bromine water, the six traps being connected to the outlet tube in that sequence. The air, which was aspirated through the vessel containing the fabric, was first dried by passage through a drying tower and then heated to the drying or curing temperature by passage through a coil of copper tubing mounted in the oven.

The procedures for the drying and curing of the fabric sample were essentially the same, except that a temperature of 92°-93°C for 30 minutes was employed for drying, whereas 142°C for 7 minutes was used for curing. In each case, the apparatus mounted in the oven and the three cold traps were allowed to equilibrate to the desired operating temperatures. The bromine-water traps were then filled and the various traps were assembled using glass-to-glass connections. A slight vacuum was applied to the exit tube of the last bromine-water trap to provide a moderate flow of air (100-200 cc per min) through the apparatus. The fabric sample was rolled around the carrier and rapidly inserted in the drying chamber, after which heating was continued for the prescribed drying or curing time. At the end of this time, the drying chamber was cooled rapidly by means of a water bath and the apparatus was disassembled. Then, 5 ml of bromine water was added to the contents of each of the cold traps to act as an oxidizing medium, followed by 1 ml of concentrated sulfuric acid. A similar quantity of acid was also added to each bromine water trap. The contents of each trap were then transferred

[1] One of the laboratories of the Southern Utilization Research Branch, Agricultural Research Service, U S Department of Agriculture.

with water to Kjeldahl flasks, and after a period of digestion, aliquots were used for colorimetric determination of phosphorus by the isobutyl-alcohol method *(4, 5)*. The weight of the fabric sample at the end of the drying and the curing steps was obtained. Subsamples of the ground, cured fabric were analyzed for phosphorus by the reduced-molybdate-colorimetric method *(5)*.

The remainder of the ground, cured fabric was washed repeatedly with 60°-70°C distilled water, and the combined washings were digested and analyzed for phosphorus by the reduced molybdate method. The washed fabric was air-dried and then analyzed for phosphorus in a similar manner.

CHARRING OF FABRICS——Two types of chemically treated cotton fabrics were used in the charring experiments: THPC-trimethylolmelamine-urea-treated 8-oz khaki twill *(7)*; and phosphorylated cotton sheeting (48 x 48), prepared by the phosphoric acid-urea method *(2)*.

The charring apparatus consisted of a Vycor combustion tube (19 x 25 x 1000 mm) mounted in an electric furnace, the temperature of which was maintained at 400°C by means of a variable voltage transformer. Approximately two inches of the constricted end of the tube was allowed to extend outside the furnace for connecting to the absorption train. The absorption train used was identical to the one employed in the drying and curing experiments.

Each of the fabrics was sampled using a checkerboard pattern. Alternate ½-inch x ¾-inch pieces were segregated for analysis before charring and for the charring operation. Four 0.5-gram portions of fabric in a single layer in glazed porcelain combustion boats were charred for 20 minutes at 400°C in the apparatus, which previously had been allowed to reach temperature equilibrium. During this charring period, as well as during the subsequent time required to cool the combustion tube, the volatile products were aspirated into the traps by the application of a slight vacuum to the end of the absorption train. The cold bath temperatures were also maintained throughout this period. After the combustion tube had cooled, the various traps were disconnected and their contents analyzed for phosphorus as previously described. The inside of the combustion tube and the porcelain boats (after removal of charred fabric) were rinsed with water and then with acetone to dissolve tarry residues. The phosphorus found by analysis of these solutions following the usual procedure was added to that found in the 0° to −5°C trap of the absorption train. The small amount of carbonaceous material remaining in the combustion tube was burned, and the gases were aspirated into saturated bromine water, which was then analyzed for phosphorus after sulfuric-acid digestion. This phosphorus was also included in the 0° to −5°C category. Four 0.5-gram portions of uncharred fabric were analyzed for phosphorus by the usual reduced-molybdate method. The four portions of charred fabric were burned in a Parr oxygen bomb at 30 atmospheres pressure prior to the usual colorimetric determination of phosphorus. This was necessary, inasmuch as it was found that low phosphorus values were occasionally obtained when charred fabrics were analyzed using the wet-digestion procedure.

TABLE I

DISTRIBUTION OF PHOSPHORUS UPON DRYING, CURING, AND WASHING THPC-RESIN-TREATED COTTON TWILL

Fraction	*Phosphorus*	*Phosphorus, washed, cured fabric basis*	*Distribution of total phosphorus*		
			In washed, cured fabric	*In wet treated fabric*	*In cured fabric*
	%	%	%	%	%
"Wet" treated fabric (67.77% wet pickup)	0.99	1.48	125.8	100.0	
Drying step (30 min, 92-93° C)					
"Dried" treated fabric	1.35	1.45	122.9	97.73	
Easily condensable phosphorus compounds (0 to −5° C)	0.00009[1]	0.0001	0.012	0.009	
More volatile phosphorus compounds (−65° C)	0.00009[1]	0.0001	0.012	0.009	
Phosphorus compounds oxidized in bromine-water traps	0.0002[1]	0.0003	0.030	0.024	
			Recovery	97.77	
Curing step (7 minutes, 142° C)					
"Cured" treated fabric	1.38	1.45	122.8	97.66	100.0
Easily condensable phosphorus compounds (0 to −5° C)	0.0002[2]	0.0002	0.022	0.018	
More volatile phosphorus compounds (−65° C)	0.0000	0.0000	0.000	0.000	
Phosphorus compounds oxidized in bromine-water traps	0.0002[2]	0.0002	0.015	0.012	
			Recovery	97.69	
Washing step (60-70° C water)					
"Washed, cured" fabric	1.18	1.18	100.0		81.43
Water washings	0.25[3]	0.26	22.32		18.18
				Recovery	99.61

[1] On "wet" fabric basis.
[2] On "dried" fabric basis.
[3] On "cured" fabric basis.

RESULTS AND DISCUSSION.

In the processing experiments with THPC-treated fabric, the drying conditions were 30 minutes at 92°-93°C, and the curing conditions, 7 minutes at 142°C. The latter conditions are essentially the same as recommended for processing 8-oz cotton twill *(7)*. The 30-minutes drying time employed is considerably longer than that required for ordinary processing, but it was necessary in order to obtain thorough drying of the wet fabric under the experimental conditions employed. The length of time the fabric is dried is not considered critical *(7)*. The loss-in-weight upon drying the wet fabric (67.77% wet pickup) in the present experiments was 28.44%. Similarly, the dried fabric lost 2.08% in weight upon curing, and the cured fabric lost 4.78% in weight upon washing with water.

The distribution of phosphorus upon drying, curing and washing the THPC-treated cotton twill is tabulated in Table I. The results are given on two general bases: 1) as percent phosphorus, based on fabric weight, and 2) as percent of the total phosphorus in the fabric. The phosphorus content of the wet treated fabric was 0.99%. This value was calculated from the wet pickup and the analytically determined phosphorus content of the resin-forming solution, since it was found impractical to analyze subsamples of the wet fabric. Preliminary drying experiments indicated that the necessarily slow drying procedure resulted in some non-uniformity of treatment in the dried fabric, presumably due to migration of the treating solution. Therefore, the phosphorus content of the dried fabric, 1.35%, was calculated from that of the cured fabric (1.38%), and that of the traps, during the drying and curing steps. The washed, cured fabric contained 1.18% phosphorus. The percent efficiency of the process (ratio of phosphorus in washed, cured fabric to phosphorus in wet fabric) was found to be 79.5 for this investigation. The resin "add-on," based on the untreated fabric, was 11.93%, which is somewhat lower than is usually obtained by pilot-plant-processing conditions.

During the drying as well as the curing step of the process, relatively small

TABLE II

DISTRIBUTION OF PHOSPHORUS UPON CHARRING THPC-RESIN-TREATED COTTON TWILL FOR 20 MINUTES AT 400° C[1]

Fraction	*Phosphorus, original fabric basis*	*Distribution of total phosphorus, original fabric basis*
	%	%
Original fabric	1.59	100.0
Charred fabric	1.52	95.6
Easily condensable phosphorus compounds (0° to —5° C)	0.038	2.39
More volatile phosphorus compounds (—65° C)	0.0025	0.16
Phosphorus compounds oxidized in bromine-water traps	0.0017[2]	0.11
	Recovery	98.26

[1] The tabulated values are averages of several charring experiments.
[2] This value is equivalent to 0.0019% PH_3, based on fabric weight.

TABLE III

DISTRIBUTION OF PHOSPHORUS UPON CHARRING PHOSPHORYLATED COTTON SHEETING FOR 20 MINUTES AT 400° C

Fraction	*Phosphorus, original fabric basis*	*Distribution of total phosphorus, original fabric basis*
	%	%
Original fabric	5.21	100.00
Charred fabric	5.08	97.5
Easily condensable phosphorus compounds (0° to —5° C)	0.087	1.67
More volatile phosphorus compounds (—65° C)	0.0000	0.000
Phosphorus compounds oxidized in bromine-water traps	0.0003[1]	0.006
	Recovery	99.18

[1] This value is equivalent to 0.00033% PH_3, based on fabric weight.

amounts of phosphorus compounds were evolved and trapped in the system employed. The following percentages of phosphorus (based on washed, cured fabric weight) were found for the drying and curing steps, respectively: 0.0001, 0.0002% in the 0° to —5°C trap; 0.0001, 0.0000% in the —65°C traps; and 0.0003, 0.0002% in the bromine-water traps. It is believed that the easily condensable phosphorus compounds (0° to —5°C) should consist of the phosphoric acid, phosphine oxides, or related types. More volatile phosphorus compounds, with the exception of phosphine, should be trapped at —65°C. Phosphorus in the bromine-water traps should consist of phosphine-phosphorus.

The distribution of phosphorus from the wet-fabric stage through the curing step can best be seen by calculating the results on the basis of the total phosphorus in the wet fabric. On this basis, 97.73% remains in the dried fabric and 97.66% is present in the cured fabric. Since the quantities of phosphorus found in the various traps are small, the overall recovery of phosphorus is approximately 97.7% from the wet fabric through the cured fabric stage. When the cured fabric was washed with water, 81.43% of the total phosphorus present in the cured fabric remained in the washed, cured fabric and 18.18% was found in the water washings. Therefore, the recovery of phosphorus for this step was 99.61%.

Although the results of this investigation indicate that rather small amounts of phosphine are evolved upon drying and curing THPC-treated fabric under the experimental conditions employed, the drying and curing equipment used in this process should be well vented nevertheless in view of the toxicity of this gas and the fact that considerable quantities of formaldehyde are also evolved. According to Sax *(9)*, 7 ppm of phosphine can cause serious effects after only several hours of exposure and 290 to 430 ppm is considered dangerous to life after an exposure of 1 hour. Although this material has a very offensive odor reminiscent of spoiled fish and garlic, this odor is not considered an effective warning property since the threshold limit for odor perception is about 1 ppm.

The conditions used for charring the THPC-treated fabric in this investigation were 20 minutes at the "medium" temperature of 400°C. Uniform black chars, still retaining the fabric structure, were obtained under these conditions. The loss-in-weight values for four charring experiments ranged from 48.9 to 59.8%, with an average of 52.7%.

The distribution of phosphorus upon charring the THPC-treated fabric is given in Table II. It can be seen that the average phosphorus content of the original fabric was 1.59%, whereas the charred fabric contained an average of 1.52% phosphorus. Therefore, the charred fabric retained 95.6% of the total phosphorus and the remaining 4.4% was volatilized. The greatest amount of the volatilized phosphorus (2.39% of the total phosphorus in the fabric) consisted of easily condensable phosphorus compounds. There was a relatively small percentage (0.16%) of more volatile phosphorus compounds, which could be trapped at —65°C. Only 0.11% of the phosphorus passed through the cold traps and was absorbed in the bromine-water traps. It is believed that this phosphine-phosphorus is completely absorbed and oxidized, since essentially all of it was found in the first of the three bromine-water traps. The data show that the following percentages of phosphorus, based on fabric weight, were trapped in the various traps: 0.038% at 0° to —5°C; 0.0025% at —65°C; 0.0017% in bromine water. The latter value is equivalent to 0.0019% PH_3, based on fabric weight. The recovery of phosphorus in the charring experiments was 98.3% of the total phosphorus present in the original fabric.

When control samples of untreated 8-oz khaki cotton twill were charred under the same conditions, an average loss-in-weight value of 66.8% was obtained. Both the uncharred and the charred fabric gave low, insignificant phosphorus values, which were within the error of the analytical methods used. The amounts of phosphorus found in the various traps were also insignificant, being essentially comparable to the amounts present in the reagent blanks.

In order to compare the charring behavior of THPC-treated fabric with that of another type of phosphorus-containing flame-resistant fabric, samples of phosphorylated cotton sheeting prepared by the phosphoric acid-urea method of Ford and Hall *(2)* were charred for 20 minutes at 400°C. The average loss-in-weight for this fabric was 47.4%, which is slightly less than that found for THPC-fabric. The distribution of phosphorus is given in Table III. The average phosphorus content of the uncharred fabric was 5.21% and that of the charred fabric, 5.08%. Consequently, 97.5% of the total phosphorus was retained by the charred fabric, and the remaining 2.5% was volatilized. Essentially all of the volatilized phosphorus accounted for (1.67%) was easily condensable and believed to be of the phosphoric-acid type. Although there was an apparent, but very small quantity of phosphorus present in the first bromine-water trap, it may have been due to experimental error of the colorimetric method rather than to the presence of phosphine. The recovery of phosphorus in this experiment was 99.2%.

SUMMARY

The distribution of phosphorus during laboratory-scale processing and charring of a typical THPC-resin-treated flame-resistant cotton fabric was investigated.

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THE ROTPROOFING AND WEATHERING PROPERTIES OF SOME COMPOUNDS OF DEHYDROABIETYLAMINE

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A study has been made of the permanence to outdoor weathering of a) copper and zinc complexes of dehydroabietylamine in association with 2-ethyl hexoic acid and 8-hydroxyquinoline and b) dehydroabietylammonium pentachlorophenoxide, applied to unbleached cotton duck. The tendency of the compounds to enhance or suppress actinic degradation, as measured by loss in breaking strength and by increase in cuprammonium fluidity, has been determined. The fungicidal efficacies of the compounds as measured by the soil-burial procedure have been investigated. Comparison was made with the behavior, under similar conditions, of fabric treated with copper naphthenate and copper 8-hydroxyquinolinolate.

The metal complexes underwent almost complete loss of metal on weathering, although the extent of this loss could be reduced by the incorporation of wax in the treatment. There was no evidence of enhanced actinic breakdown of the treated samples. The copper complex provided a satisfactory level of protection against microbiological attack, intermediate between those of copper naphthenate and copper 8-hydroxyquinolinolate, and that of the zinc complex was relatively high also. The pentachlorophenoxide showed poor stability to weathering, and this was not improved in the presence of wax; but in the absence of weathering it provided good protection against microbiological attack over the range studied.

When used as an aftertreatment on mineral-dyed duck, the effect of the chromium in reducing loss of copper from samples treated with the copper complex, and of reducing actinic degradation, was marked.

INTRODUCTION

DURING World War II there was considerable interest shown in ways and means of preserving cellulosic textiles exposed outdoors, especially in tropical or subtropical climates. The past few years have seen a revival of this interest, which appears to be largely due to the increasing realization that microbiological deterioration of materials is not as largely confined to tropical or subtropical areas as was previously thought to be the case, but can occur in any geographical location where the necessary conditions of temperature and relative humidity are present. The continued interest in this problem as it applies to cellulosic textiles is shown by the number of papers and reports in this field which have appeared in the past few years.

One of the most important aspects of the problem is the fact that microbiological deterioration is only one of the destructive agencies to which textile materials are subjected when exposed outdoors, other agencies chiefly concerned being sunlight and the effect of repeated wetting. The term "weathering" has now come to be applied generally to the total effect of the various factors which have a known or suspected effect in promotion of degradation.

Of the various fibers involved in the outdoor use of textiles, cotton is still the most important. It is fairly readily broken down by the above-mentioned agencies, but some advances have been made in ways and means of protecting it against such damage and thus prolonging its life, and it is reasonable to assume that, until such time as a synthetic fiber or other material having the necessary resistance to these agencies and competitive in cost with cotton makes its appearance, it will be desirable to continue attempts to improve still further the resistance of cotton to weathering.

Of the destructive agencies mentioned above, sunlight is probably the most important, with microbiological attack second; hence, in the consideration of protective treatments, it is desirable to seek those which will afford maximum protection against actinic breakdown while still providing an adequate level of protection against microbiological attack. This has proved to be a difficult problem since all of the organic fungicides so far investigated have been found to show a relatively low degree of permanence. While this effect can be offset to some extent by the use of water and light barriers, such as waxes or resins, it is nevertheless desirable to continue the search for organic fungicides of still greater permanence, which will contribute protection against actinic breakdown, preferably at a lower cost than those currently used.

It has been shown that certain inorganic treatments can exert a marked protective action against actinic degradation. Recent work with compounds of chromium shows considerable promise in this respect *(1, 2)*. Moreover, work on the protective value of mixtures of chromium and copper in inorganic form has shown that the loss of copper, which occurs when inorganic copper treatments alone are used, can be substantially reduced, thus prolonging the effectiveness of the treatment against microbiological attack *(3)*. A similar effect has been noted with inorganic chromium treatments carrying organic copper aftertreatments *(3)*.

The present paper presents data on the weathering characteristics of some derivatives of dehydroabietylamine, obtained as part of a continuing study undertaken for the Canadian Armed Services on the properties of new textile fungicides. The permanence to weathering of the compounds when applied to unbleached cotton duck and the extent of their protective effect with respect to actinic breakdown and to microbiological action have been measured. The effectiveness of the copper compounds of one of these derivatives when applied as an aftertreatment on a typical mineral-dyed duck has also been investigated. Comparison of the weathering characteristics of these compounds with those of two other organic copper compounds, viz, copper naphthenate and copper 8-hydroxyquinolinolate, which are in fairly wide use as textile fungicides, has been made. The derivatives of dehydroabietylamine investigated were a) dehydroabietylammonium pentachlorophenoxide and b) a complex in which the amine had been reacted with a mixture of 2-ethyl hexoic acid and 8-hydroxyquinoline and the copper or zinc salt of this prepared, with subsequent addition of magnesium hexoate *(4)*. The resultant product is available in liquid or paste forms designed for solvent or aqueous application respectively. This compound therefore contains the metals copper or zinc together with magnesium in association with the dehydroabietylamine, 2-ethyl hexoic and 8-hydroxyquinolinium radicles.

Copper compounds have been used widely as textile fungicides and it is believed that the most effective of these, so far investigatetd, is copper 8-hydroxyquinolinolate. Dehydroabietylamine is known to have some fungicidal potency and it is also known that the mixtures of metallic compounds frequently show a synergistic effect with respect to fungicidal potency *(5)*. Therefore it was considered that a complex of the above-mentioned type might possess a fungicidal potency intermediate between those of the relatively costly copper 8-hydroxyquinolinolate and the relatively cheap copper naphthenate, and also that it might not enhance actinic breakdown of cotton. This follows from the observation, frequently

made in the laboratory, that copper 8-hydroxyquinolinolate actually confers some protection against actinic degradation and that copper naphthenate does not cause appreciable degradation when present in amounts corresponding to a content of 0.3% or less of copper on the treated fabric.

MATERIALS AND TREATMENTS

The materials and treatments used in the study were as follows:

Unbleached duck—an unsized army duck weighing 11.7 oz/sq yd (10-oz commercial designation) and having 53 3-ply warp and 43 3-ply filling yarns per inch.

Mineral-dyed duck—a portion of the unbleached duck which had received a commercial mineral-dyeing treatment. The contents of chromium oxide (Cr_2O_3) and of ferric oxide (Fe_2O_3) were 0.21% and 1.22% respectively.

Fungicides—these were all commercial products. Their characteristics are shown in Table I together with the abbreviations used for them in this paper.

Fungicide treatments. In most cases the fungicides (or the fungicide plus wax) were applied from solution in Stoddard solvent. Pieces of the duck, 6" x 18", with the short dimension in the direction of the warp, cut from the main supply and randomized, were soaked in solution in Stoddard solvent of the appropriate concentrations, allowed to drain, placed between three thicknesses of blotting paper on each side and passed through squeeze rolls. In the case of the aqueous emulsion treatments it was found necessary to immerse and squeeze several times in order to get good penetration. Specimens 6" x 3" were cut from the ends of the treated pieces. The various speciments thus obtained from several pieces carrying a given treatment were cut into small pieces, which were thoroughly mixed, from which the samples for analysis for content of fungicide were taken.

Waxing treatments. In most cases the waxing treatment consisted of a mixture of paraffin wax and petrolatum having the characteristics outlined in Table II. The paraffin wax and petrolatum were used in the ratio of 3:1 by weight and were applied from a solution of a concentration calculated to give approximately 10% of mixture on the weight of the fabric (owf).

In some of the aqueous emulsion treatments used, the wax was present in the treating compound as received. Were this was the case, the amount of wax on the treated samples was substantially lower than on the samples which received the paraffin wax-petrolatum treatment.

TABLE I
FUNGICIDES USED

Compound	*Characteristics*	*Abbreviation Used*
Copper naphthenate	A concentrate containing 8% copper	CuN
Copper 8-hydroxy-quinolinolate	A solvent-soluble preparation *(8)* containing 1.8% copper	Cu8
Copper complex of dehydroabietylamine	Solvent-soluble and water-dispersible forms	CuD
Zinc complex of dehydroabietylamine	Solvent-soluble and water-dispersible forms	ZnD
Dehydroabietylammonium pentachlorophenoxide	Solid	DP

TABLE II
CHARACTERISTICS OF WAXING MIXTURE USED

	Parowax[1]	*Petrolatum No. 2*[2]
Melting point (°F)	122-125	114-120
Say visc at 210°F (sec)	33-38	64-71
Penetration at 77°F (cone)	—	170-220
Color	+25 + Say (water white)	35Y 70R 2-in cell
Oil content (%)	0.5 max	approx 35

[1] Parowax (refined paraffin wax), Imperial Oil Ltd. Sarnia, Ontario.
[2] Petrolatum No. 2, Imperial Oil Ltd, Sarnia, Ontario.

TEST METHODS

Breaking Strength was measured on one-inch-wide ravelled-warp specimens, which were broken on a motor-driven pendulum-type Scott Tensile Tester using 3-inch jaw spacing and a pulling speed of 12"/minute. The samples were conditioned at 65 ± 2% RH and 70 ± 2°F for 24 hours prior to testing. Ten breaks were carried out on each sample and the results averaged.

Chemical Damage was measured by the cuprammonium fluidity method. The reagent contained 15.0 ± 0.1 gpl copper and 200 ± 10 gpl ammonia (NH_3). The dispersions used contained 0.5% cotton previously conditioned as above, the measurements being made at 20 ± 0.1°C. Samples containing wax were solvent-extracted in a Soxhlet with benzene before testing.

Content of Zinc———8 to 10 g of the fabric was weighed accurately, cut into small pieces, and digested with 250 ml of dilute nitric acid (1:1 by volume) for about 20 minutes or until the sample had disintegrated completely. The mixture of fiber and liquid was poured onto a sintered glass filter and the residue washed with 15-25 cc water, after which the residue again was digested with 75 cc dilute nitric acid and again filtered and washed as before, the filtrates being combined. 10 ml concentrated sulfuric acid was added to the latter and the mixture boiled down to white fumes. Where traces of organic materials were present, as shown by the solution being colored, these were removed by adding small amounts of concentrated nitric acid and boiling. The final clear and colorless solution was cooled, diluted to 150 cc with water, and made alkaline with ammonium hydroxide to precipitate aluminium. The aluminium hydroxide was filtered off and the pH of the filtrate adjusted to 6-7, using methyl red indicator. The solution was heated to near boiling and 30 ml of freshly prepared 20% solution of diammonium hydrogen phosphate was added. The mixture was kept hot for 30 minutes, allowed to stand for 1-2 hours, filtered through a Gooch crucible, and the precipitate washed with a 1% solution of diammonium hydrogen phosphate and then with a neutral 50% alcohol solution. It was then ignited to constant weight at 900-1000°C and weighed as zinc pyrophosphate.

Content of Copper———as previously reported *(3)*.

Content of Pentachlorophenoxide———The method used is based upon the formation, in acid aqueous solution, of a yellow salt resulting from the reaction of the amino group of the compound with Bromphenol Blue (tetrabromophenolsulfonphthalein). This colored salt, which is relatively insoluble in water, is extracted from the reaction mixture with benzene and its amount determined colorimetrically.

TABLE III

COMPARISON OF WEATHERING CHARACTERISTICS OF CuN, Cu8, CuD, ZnD, AND DP WITH AND WITHOUT WAX

Compound	Original metal content (%)	Loss of metal on weathering (%)	Breaking Strength Loss (%) Weathered	Leached & buried 2 weeks; not weathered	Leached & buried 4 weeks; not weathered	Increase in fluidity on weathering (rhes)
(A) WITHOUT WAX						
Untreated Duck (1952)	—	—	51	94	95	16.2
CuN (1952)	0.08	94	36	76	99	10.8
from	0.23	94	40	65	90	13.1
solvent	0.44	86	44	23	57	13.7
Cu8 (1952)	0.016	94	45	2	54	14.4
from	0.034	74	37	1	9	13.3
solvent	0.09	85	38	0	4	12.1
	0.21	75	38	0	1	11.6
Cu8 (1952)	0.01	85	48	100	100	11.8
from aqueous	0.04	92	42	59	76	9.3
emulsion	0.09	96	42	0	9	9.9
	0.18	73	47	3	16	10
CuD (1952)	0.07	95	38	31	43	14.1
from	0.14	95	39	15	24	11.7
solvent	0.23	85	41	8	8	10.9
	0.31	84	41	13	0	11.3
CuD (1952)	0.08	95	44	17	60	13.1
from aqueous	0.13	95	48	11	10	14.7
emulsion	0.21	90	51	17	2	13.2
ZnD (1952)	0.08	100	51	52	100	15.9
from	0.14	100	50	10	9	16.5
solvent	0.30	100	53	14	3	15.8
	0.46	100	51	1	10	15.5
ZnD (1952)	0.13	100	46	15	76	13.9
from aqueous	0.22	100	47	6	35	15.7
emulsion	0.36	100	54	8	18	17.1
	0.52	100	50	8	11	12.3
Untreated Duck (1953)	—	—	39	100	—	14.0
Cu8 (1953)	0.037	87	28	—	—	8.1
from solvent	0.10	82	25	3	14	8.1
	0.21	73	26	—	—	8.6
DP (1953)	0.53*	100	33	35	100	12.3
from solvent	1.07*	100	36	0	6	15.4
	2.19*	100	42	0	6	17.3
(B) WITH WAX						
Duck control containing wax treatment only (1952)	—	—	68	93	93	16.7
CuN (1952)	0.08	63	67	77	99	11.9
from	0.19	60	56	32	83	11.9
solvent	0.49	43	59	0	78	13.8
Cu8 (1952)	0.014	71	57	3	28	14.0
from	0.053	57	61	0	6	13.3
solvent	0.10	56	54	2	8	13.0
	0.20	21	45	0	5	9.1
Cu8 (1952)	0.01	80	45	43	88	14.7
from aqueous	0.03	88	47	11	40	13.4
emulsion	0.09	77	56	8	15	9.3
CuD (1952)	0.06	73	58	6	6	9.1
from	0.12	68	52	0	0	9.4
solvent	0.22	66	50	9	15	10.0
	0.29	63	44	16	7	10.0
CuD (1952)	0.05	76	44	9	34	7.5
from aqueous	0.10	84	48	13	16	8.1
emulsion	0.15	77	47	8	19	7.4
	0.19	69	49	9	8	10.3
ZnD (1952)	0.09	100	66	18	63	16.8
from	0.14	100	67	13	33	15.1
solvent	0.31	76	64	0	2	12.7
	0.44	75	62	0	5	12.9
ZnD (1952)	0.11	100	54	19	89	13.6
from aqueous	0.18	100	60	6	43	16.9
emulsion	0.29	100	62	20	17	18.1
	0.34	100	61	29	13	13.6
Duck control containing wax treatment only (1953)	—	—	56	—	—	12.3
Cu8 (1953)	0.047	60	54	—	—	11.7
from solvent	0.12	38	45	—	—	9.3
	0.23	22	35	—	—	9.8
DP (1953)	0.47*	approx 100	60	0	66	15.0
from solvent	0.96*	approx 100	66	0	4	12.7
	2.03*	approx 100	67	0	0	13.2

* Given as dehydroabietylammonium phenoxide.

The Bromphenol Blue solution contained 250 mg of the dye dissolved in a mixture of 300 ml glacial acetic acid and 1200 ml water. Standard reference solutions containing the colored reaction products for use in preparing the calibration curve were made up as follows:

Approximately 100 mg of the penetachlorophenoxide was dissolved in benzene and made up to 100 ml. Aliquots of 2, 5, 10 and 20 ml were taken and diluted to 100 ml with benzene, these being used in the preparation of the curve. To do this, 25 ml of the aqueous acetic acid-Bromphenol Blue solution were pipetted into a separatory funnel and 25 ml of the diluted pentachlorophenoxide solution added. The funnel was shaken gently for 1-2 minutes, the two layers allowed to separate, and the transmittance of the benzene layer determined on a spectrophotometer at 410 mμ. Since the aqueous acetic acid solution of Bromphenol Blue is not stable, fresh batches were made up as required.

In determining the pentachlorophenoxide content of the treated samples, an accurately weighed specimen of the fabric, cut into small pieces, was extracted with benzene and the extract made up to 250 ml. The preparation of the colored reaction product with Bromphenol Blue was carried out as above, using a 25-ml aliquot of the extract and 25 ml of the standard Bromphenol Blue solution. If the 25-ml aliquot of the extract contained more than 0.5 mg of the compound, it was diluted appropriately.

Exposure to Weather was carried out at Ottawa, Ontario, from June 13 to October 14, 1952 and from June 12 to October 13, 1953. The samples were fastened to racks set at an angle of 45° and facing south.

Resistance to Microbiological Attack was measured by means of the soil-burial test. The 6" x 15" samples were leached in running tap water at 25 ± 1°C for 24 hours, and divided in half, each duplicate piece being buried in different flats. One-inch ravelled specimens for breaking strength measurements were prepared from the leached original and from the buried samples. In general, the range of breaking strengths of the ten replicates in the case of the weathered samples, was less than 10 lbs, the error of the means for the various sets of 10 replicates ranging from 2 to 4 lbs. With the samples which had been subjected to the soil burial test the range for the ten replicates is considerably greater. This is a normal observation in tests of this kind and is chiefly due to the lack of uniformity of microbiological attack throughout the test piece together with some unavoidable variations in the cellulolytic activity of the soil in various flats.

DATA

Data for rainfall, temperature and hours of sunshine are as previously given *(3)*. The data for the effects of weathering on CuN, Cu8, CuD, ZnD and DP applied from solution in solvent with and without

wax are given in Table III together with those for the effects of different methods of applying the compounds. A comparison of the weathering characteristics of CuN, Cu8 and CuD, when applied as an aftertreatment on mineral-dyed duck, is given in Table IV.

DISCUSSION

A) Compounds Used in Direct Treatments

LOSS OF COMPOUND ON WEATHERING——The solvent- and aqueous-applied CuD compounds showed high losses of metal, these being about the same as those shown by CuN and somewhat greater than those by Cu8. The presence of wax reduced the loss of the CuD compounds but not to as great an extent as with CuN and Cu8. The ZnD compounds (solvent and aqueous) were completely lost in the absence of wax, and even when wax was present they showed complete loss at the lower levels of solvent treatment and in the case of all of the aqueous-dispersion treatments. In general it may be said that the CuD and ZnD compounds are removed from waxed samples to a somewhat greater extent than are CuN and Cu8. These latter two compounds, when applied from solvent, show a tendency to be lost to a decreasing extent as the level of treatment is increased; this does not seem to be the case with the CuD compounds. The poor resistance shown by the ZnD compounds is similar to that of the naphthenate and dimethyldithiocarbamate *(6)*.

The DP compound was completely removed from the unwaxed samples and only a trace of it could be detected in the waxed samples.

DAMAGE CAUSED BY WEATHERING——With respect to breaking strength losses it will be noted that, in the absence of wax and in a concentration range of 0.14 to 0.3% copper, the samples carrying the CuD treatments show breaking strength losses intermediate between those of samples containing approximately 0.1% copper as Cu8 and 0.4% copper as CuN, the two latter percentages being those frequently used in commercial treatments employing Cu8 or CuN respectively. It is of interest to note that, in most cases, all three copper compounds gave lower breaking strength losses than the untreated control. The CuD shows a degree of protection of the fabric very close to that of CuN and Cu8.

The ZnD compound, in the absence of wax, affords no protection against actinic breakdown; but with wax present, some protection is apparent especially in the aqueous-dispersion treatments.

The DP compound showed evidence of affording some protection against actinic breakdown, although when wax was present, this effect was not particularly marked.

TABLE IV

EFFECT OF COPPER COMPOUNDS APPLIED AS AN AFTERTREATMENT, WITH AND WITHOUT WAX, ON MINERAL-DYED DUCK

Compound	Original metal content (%)	Loss of metal on weathering (%)	Breaking Strength Loss (%) Weathered	Leached & buried 2 weeks; not weathered	Leached & buried 4 weeks; not weathered	Increase in fluidity on weathering (rhes)
(A) WITHOUT WAX						
Duck control mineral-dyed (1952)	—	—	28	88	90	10.0
CuN (1952)	0.09	74	35	80	93	11.0
from	0.25	69	34	38	51	12.1
solvent	0.52	63	34	0	10	16.6
Cu8 (1952)	0.03	64	29	2	0	8.4
from	0.06	68	27	0	0	8.0
solvent	0.13	80	26	0	0	6.7
Cu8 (1952)	0.04	47	25	0	12	9.9
from aqueous	0.07	59	23	11	6	10.6
emulsion	0.09	61	24	0	0	9.9
CuD (1952)	0.07	60	31	3	3	8.4
from	0.27	70	25	9	0	8.5
solvent						
CuD (1952)	0.13	78	21	0	0	8.6
from aqueous	0.17	77	27	2	0	9.3
emulsion						
(B) WITH WAX						
Duck control mineral-dyed & waxed (1952)	—	—	40	91	88	10.5
CuN (1952)	0.10	28	50	86	91	15.5
from	0.25	13	51	12	14	16.8
solvent	0.54	14	49	18	4	16.2
Cu8 (1952)	0.03	18	43	0	0	10.2
from	0.07	3	44	0	0	7.7
solvent	0.15	5	38	0	0	5.4
Cu8 (1952)	0.03	0	37	0	9	6.2
from aqueous	0.05	37	34	6	5	7.5
emulsion	0.08	43	31	0	0	5.6
CuD (1952)	0.08	0	44	0	0	5.2
from	0.20	35	34	2	0	5.1
solvent						
CuD (1952)	0.09	44	27	6	0	6.7
from aqueous	0.16	56	—	0	0	6.5
emulsion						

RESISTANCE TO MICROBIOLOGICAL ATTACK——It will be noted that the CuD gave markedly better protection than did CuN. The presence of wax seemed to intensify this effect to the point at which the protection afforded by CuD was comparable with that afforded by Cu8. The ZnD likewise showed a surprisingly high level of protection, being in excess of that shown by CuN. In the unweathered samples, the DP compound gave excellent resistance over most of the range of concentrations studied.

B) Copper Compounds Used as Aftertreatments on Mineral-Dyed Duck

LOSS OF METAL ON WEATHERING——All of the compounds showed lower losses of copper than was observed in the absence of the mineral dye, this undoubtedly being due to the presence of the chromic oxide in the mineral dye. The losses shown by the CuD-treated samples were generally of the same order as those involving CuN and Cu8, the only exception being the Cu8 applied from aqueous dispersion, which showed a lower loss.

Results were similar on the wax-treated samples, in all of which effect of the wax in reducing loss of the compounds was apparent.

DAMAGE CAUSED BY WEATHERING——The usual protective effect of the chromic oxide in the mineral dye was shown by the control sample. The CuN-treated samples showed evidence of somewhat greater damage than the control, while the other copper compounds showed approximately the same or slightly greater protection of the fabric than the control. Results were similar with the waxed samples although the effect of the presence of wax in increasing breaking strength losses was noted. This effect, which relates to the use of soft petroleum-base waxes or mixtures of these with the higher-melting point paraffin waxes, will be the subject of a forthcoming paper.

With these treatments in the presence of water, the organic-copper compounds may undergo at least partial hydrolysis to

(concluded on page 676)

• PATENT DIGEST •

PAUL WENGRAF

WATER-REPELLENT FINISH ———Methylolamides of High Fatty Acids Combined with Certain Quaternaries G,2,02

US Pat 2,692,837 (General Aniline & Film——Cross, Mayhew——Oct 26, 1954)

It is known generally that water-repellent finishes of the Zelane type, such as those containing quaternary compounds linked to fatty-acid amides by a methylene group, are highly efficient initially; however, their effectiveness is substantially impaired upon washing and drycleaning.

The introduction to this patent mentions, among others, USPat 2,189,648 [I G Farben-Geunther (1940)], which describes self-dispersing condensates of this class (see reference below). On the other hand, self-emulsifying preparations based on *alkanolamides* of higher fatty acids also have been advocated as water-repellent agents [cf USPat 2,431,202 (Sanders)]. In the latter case the emulsifiers ultimately are removed upon washing after impregnation, leaving only the alkanolamides in the fiber. In contrast, quaternary compounds used as emulsifiers for the alkanolamides may impart affinity to textiles, but serious discoloration frequently occurs in subsequent curing.

According to the present specification, a composition has been developed which emulsifies well, and which, upon curing, imparts a hydrophobing finish of good resistance to washing and drycleaning. It reportedly will not yellow or discolor the fabric. It is based on a *combination of methylolamides* with certain high substituted quaternary bases of the general formula

$$A - CH_2 - N(tert) - X$$

wherein "X" is an anion. The nature of "A" is the key to optimum effects: it may be a higher alkylcarbamide group (example 1 of the specification) or it may be comprised of long chains containing ethenoxy groups (examples 2 and 3).

In the preparation of the self-emulsifying compositions, the quaternary nitrogen compounds (as represented by the above formula) are dissolved in a lower alcohol, eg, isopropanol, and the methylol—fatty acid amide is added in melted form. The preferred ratio of quaternary compound to methylolamide is between 1:1 and 1:2.

These compositions are applied from emulsions of 3-8% concentration. The fabrics are impregnated, dried and cured (from 120-150°C within 2 minutes down to 45 seconds).

The effects imparted by the above method are said to show an initial spray rating of 100, which decreases only slightly after three washing and drycleaning cycles. In contrast, the single components of this composition give poor results under identical conditions.

Examples:

Methylolstearamide (as the active ingredient) may be emulsified with solutions of

a) sulfonated condensates of pyridine and methylolstearamide (example 1—see references to USPat 2,189,648 below):

b) diamylphenoxy pyridinium chloride (example 2); or

c) dodecylphenoxy ethoxymethyl pyridinium chloride (example 3), etc.

The emulsifiers are not restricted to pyridinium compounds; they may also be based on other tertiary aliphatic or aromatic amines.

Among the references cited by the Patent Office:

USPat 2,168,535 [I G Farben (1939)]: covers a hydrophobing process comprising the application of stearoxymethyl pyridinium chloride combined with copolymers of maleic anhydride and a higher nonsaturated ether compound.

USPat 2,313,742 [Du Pont (1943)]: higher acid methylolamides may be condensed with polyhydroxy compounds, that are alkali-soluble, such as glycollic or lactic acids and used in water-repellent treatments.

USPat 2,314,277 [Rohm & Haas (1943)]: durable glazing effects may be obtained by treating a fabric with a water-soluble cellulose derivative in the presence of a quaternary, high substituted compound, subjecting it to the usual mechanical treatments and curing.

USPat 2,431,202 [Gen Aniline (1947)]: a self-emulsifying product of the methylolstearamide type for hydrophobing purposes may be prepared by melting the methylolamide, dissolving emulsifiers in the melt, cooling and transforming the product into powder form.

Brit Pat 484,906 [I G Farben (1938)]: a condensate of a high substituted aromatic halogen compound will react with an amine for various uses as a textile assistant.

Brit Pat 501,288 [Imp Chem Ind (1939)]: combining the Velan finishes with urea-formaldehyde resins.

USPat 2,189,648 [I G Farben (1940), quoted in example 1]: surfactants may be obtained by forming the methylol compound of a higher amide and sulfonating the condensate with sulfur dioxide.

LEUCO VAT DYES Stabilized with Cobalt Compounds C,4,02

US Pat 2,690,912 (Am Cyanamid——Fordemwalt——Oct 5, 1954)

The preamble to this patent quotes from a series of US patents (2,548,543-6 and 2,576,846), which are assigned to Cyanamid. They refer to *vat dyeing at elevated temperatures*. Some vat dyes, as enumerated in USPat 2,548,544, are sensitive to overreduction and therefore must be applied in the presence of some oxidizing compounds, eg, sodium chlorate. Another vat-dye group—the Pyranthrones, eg, Indanthrene Golden Orange Y Paste (*CI* 1096)—although not sensitive to overreduction, is generally affected by heat. These can be dyed well at elevated temperatures in the presence of said oxidizing agents [cf *Am Dyestuff Reptr 40*, 538 (1951) and *41*, 307 (1952)].

According to the present patent, the inventor observed that *cobalt compounds* also prevent decomposition or dulling of shades in high-temperature vat dyeing. It is stated that the mechanism of this reaction is not quite understood; however, it is suggested that the cobalt compound ($COCl_2$ in many examples) may possibly react with the reducing agent present in the vat composition, thereby transforming sodium hydrosulfite into a Co compound or complex. The cobalt compounds are not catalysts in the usual sense; they cannot be used in this process in too small amounts. Therefore it is probable that they enter into the reaction as active reagents, forming intermediate compounds with other components. It has been found that 1/60 oz per gallon of dyebath gives some improved effect, while 1/6 to 1/3 oz per gallon of dyebath gives optimum results. More than one oz/gal does not further increase the beneficial effect. (These figures are reported for an average 5% dyebath concentration).

Examples:

A dyebath prepared with a vat dye paste (Calcoloid Blue Paste, *CI* 1113) was vatted with lye and sodium hydrosulfite at 90°C while 5 p of a 5% $CoCl_2$ solution was added (bath volume about 400 p). A cotton skein was entered at this temperature and dyed for 30 minutes while the dyebath was kept alkaline. A bright blue shade resulted. A sample dyed in the absence of cobalt salt was less strongly colored and duller.

Example #4 refers to dyeing in an analogous way with an orange dye (Cal-

(Continued on page 669)

Proceedings of the

American Association of Textile Chemists and Colorists

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Editor of Proceedings: Carl Z Draves, 30 Lahey St, New Hyde Park, N Y

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AATCC CALENDAR

COUNCIL
Wednesday evening, Sept 21 (Chalfonte-Haddon Hall, Atlantic City, N J); Nov 18, Jan 20 (Hotel Statler, New York, N Y); April 20; June 15; Sept, 1956; Nov 16, 1956; Jan 18, 1957.

NATIONAL CONVENTIONS
Sept 21-24, 1955 (Chalfonte-Haddon Hall, Atlantic City, N J); 1956 (Waldorf-Astoria, New York); 1957 (Boston); 1958 (Chicago); 1959 (Washington, DC)

MID-WEST SECTION
Oct 29 (Bismarck Hotel, Chicago, Ill).

NEW YORK SECTION
Oct 14, Nov 18 (Kohler's Swiss Chalet, Rochelle Park, N J); Jan 27, Feb 24 (Hotel Delmonico, New York, N Y); Mar 23, Apr 27, May 18 (Kohler's Swiss Chalet, Rochelle Park, N J).

NIAGARA FRONTIER SECTION
Oct 14 (joint meeting with Ontario Section, CATCC); Dec 2, Jan 20 (U S); Mar 3 (Canada—meeting to be held in conjunction with Ontario Section, CATCC); Apr 27 (U S).

NORTHERN NEW ENGLAND SECTION
Oct 14; Dec 9.

PACIFIC SOUTHWEST SECTION
Oct 7, Feb 6 (Gourmet Restaurant, Beverly Hills, Calif); Dec 2.

PHILADELPHIA SECTION
Oct 21 (Penn-Sherwood Hotel); Dec 2, Jan 13 (Kugler's Restaurant).

PIEDMONT SECTION
Oct 29 (Hotel Wm R Barringer, Charlotte, N C).

RHODE ISLAND SECTION
Oct 13, Dec 1 (Johnson's Hummocks, Providence).

SOUTH CENTRAL SECTION
Dec 10 (Hotel Patten, Chattanooga, Tenn).

SOUTHEASTERN SECTION
Dec 3 (Atlanta Biltmore, Atlanta, Ga).

WESTERN NEW ENGLAND SECTION
Sept 16 (Rapp's Restaurant, Shelton, Conn); Nov 4 (Hartford, Conn); Dec 16 (Rapp's).

ACTIVITIES OF THE LOCAL SECTIONS

SOUTH CENTRAL———Highlighting the 1955 Summer Outing of the South Central Section was the announcement of the election of the following officers for 1955-56: *Chairman*——W F Luther, Dixie Mercerizing Co; *Vice Chairman*——J C Whitt, Standard-Coosa-Thatcher Co; *Secretary*——E V Helms, Geigy Dyestuffs; *Treasurer*——Frank Cater, Ray-Set Dyeing Co; *Councilor*——Joe D Mosheim, Crystal Springs Bleachery; *Sectional Committeemen*——Jack Anderson, Burlington Mills (Peerless Div) and William Blackman, Sandoz Chemical Works, Inc.

The Outing, under the chairmanship of Lowell Shive, Arnold Hoffman & Co, Inc, attracted 209 members and guests to Lookout Mountain Hotel, Chattanooga, Tenn, July 29-30. Mrs G R Bellamy was in charge of the ladies' program.

Activities began with a buffet dinner followed by a bingo game on Friday evening. Saturday's features included ladies' activities (bridge, canasta, bingo, etc); golf, casting and horseshoe pitching for the men; and a banquet followed by dancing in the evening.

Winners of the events for men were as follows:

GOLF———low gross (supplier): Daniel S Rion, Nopco Chemical Co, retired the American Aniline Products, Inc Trophy, being a 3-time winner; *low gross (millman):* Gregg Quick, Kingsboro Silk Mills, received the Mac Chemical Co Trophy; *low net (supplier):* 1st—Frank McKinney, Sandoz Chemical Works, Inc, 2nd—Bill Williams, Tennessee Corp; *low net (millman):* 1st—Harvey DeLay, Standard-Coosa Thatcher Co, 2nd—Charles Wheeler, Barwick Carpet Mills; *high gross:* Jim Ford, George E Sherman Co.

CASTING———Norman Price, Rockwood Mills.

HORSESHOE PITCHING———Singles: Norman Price; *Doubles:* Fred Price, Sweetwater Hosiery Mills, and Harvey DeLay.

(Outing photos on page P667)

EMPLOYMENT REGISTER

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association, Post Office Box 28, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the Secretary.

55-14

Education: M Sc, textile technology; BS, mechanical engg.

Experience: Textile engineer, cotton printing and finishing; research asst evaluating mechanical properties of fibers.

Age: 28; married; will be discharged from Navy in Dec, position in product development desired, anywhere in the U S.

9-12, 9-26

55-15

Education: BS, textile chemistry & dyeing; additional courses in business management.

Experience: U S Navy, lt j g, executive officer.

Age: 26; married; references, technical sales position desired.

9-12, 9-26

55-16

Education: BS, chemistry, with further courses in textiles.

Experience: textile chemist, supervisory and research.

Age: 43; married; references; position in vicinity of New York City desired.

9-12, 9-26

LATE CONVENTION NOTES

JOSEPH REDDING, internationally known world traveler and adventurer, will be the principal speaker at the Annual Banquet on September 24th in the Carolina Room of the Chalfonte-Haddon Hall, Atlantic City, N J.

Mr Redding will describe his travels through the jungles of Burma, Borneo, the Malayan peninsula, and Africa. A big game hunter of world reputation, Mr Redding spent 2½ years in Africa, collecting trophies for his collection in Lake Worth, Fla.

* * *

Buschman Products, Inc, 369 Lexington Ave, New York 17, N Y, has taken booth #18 at Atlantic City and will exhibit Carobene, a cold-water-soluble print thickener, and Centri Mogenizer, high-speed homogenizing equipment.

* * *

Dow Chemical Co, Midland, Mich, will exhibit at Booths 27 & 28, which were originally assigned to Versenes, Inc, a concern recently absorbed by Dow. The exhibit will consist of chemicals and textiles finished with the various chemicals. Also, several new dyeing and finishing agents for the synthetic fibers and fabrics will be shown.

* * *

General Electric Co will occupy booth 71 and show an operating recording spectrophotometer. There will be demonstrations in the booth and plotting of color values on a chromaticity diagram.

An Industrial Waste Guide to the WOOL PROCESSING INDUSTRY*

AATCC STREAM POLLUTION ABATEMENT COMMITTEE

INTRODUCTION

THE woolen-mill supervisor occupies a key position in reducing the polluting effects of his mill effluents. He can be particularly effective in the area of good housekeeping, which prevents wastes at the source and reduces manufacturing costs at the same time. This Guide is designed to assist him in exercising his responsibility for waste reduction and pollution control, and in recognizing those additional problems which require the services of the plant chemist and plant engineer.

With this primary purpose in mind, waste technologists and others in the Woolen Industry have attempted to design a concise, practical guide for wool-plant operating and design personnel. This Guide summarizes information made available over a period of time by many investigators. It emphasizes the appreciable reduction of waste which can be accomplished by waste-prevention measures within the processing plant. Practical methods of carrying out such waste-saving measures are discussed in some detail.

The section on waste treatment is not intended to be a comprehensive discussion of woolen-mill waste treatment. Sufficient information is included, however, to suggest possible solutions to stream-pollution problems which cannot be adequately corrected by waste-prevention procedures. Some performance data are included on various waste-treatment processes. This section may also serve to emphasize the value of waste-saving methods in reducing total waste-treatment costs.

DESCRIPTION OF PROCESS

Wool processing consists of the following steps:

1) Opening and scouring.
2) Spinning.
3) Dyeing.
4) Finishing.

In the Woolen Industry, as in many other industries, control and disposal of wastes is of major concern. There are two important reasons for increased attention to these problems: First, the greatest possible recovery, use, and reduction of wastes is necessary for most economical production in small as well as large plants. Second, protecting the Nation's limited water resources for maximum use is essential to our health and continued economic growth. Stream pollution control is mutually beneficial to industry, the individual citizen, and the Nation as a whole. Thus, wastes which cannot be eliminated must be disposed of in a manner which will not impair the usefulness of stream waters for other beneficial purposes.

This "Industrial Waste Guide to the Wool Processing Industry" is intended primarily to aid operators of woolen mills and commission processors to utilize, reduce, and otherwise suitably dispose of their wastes. Prepared by the Stream Pollution Abatement Committee of AATCC, it has been submitted for publication in booklet form to the Public Health Service through the National Technical Task Committee on Industrial Wastes, which is composed of representatives from the Nation's leading industries concerned with solving difficult industrial-waste problems. The objective of the organization is to perform technical tasks pertaining to industrial wastes in cooperation with the Public Health Service and all others concerned with improving the quality of our water resources. The preparation of this Guide was one of the tasks assumed by the Textile Industry in carrying out this objective.

There are plants which perform each of these steps separately, often on a commission basis, and there are integrated mills, which carry out all of these functions from beginning to end. The processes involved in the steps above are described briefly in the following paragraphs.

OPENING AND SCOURING——Shorn wool is packed in bales and shipped to scouring plants for the removal of foreign matter. The bales are opened around a portable conveyor and fleeces are put onto the conveyor, blending the wools from many bales. The conveyor carries the wools to a series of pronged opening machines and dusters where the fibers are gently separated, and sand, grit, grass, etc, are beaten out of the mass. Some of these impurities remain stuck to the grease on the wool.

From the dusters the wool is dropped into a continuous scouring machine, conmove the wool from bowl to bowl through which the wool is propelled by reciprocating arms. Prongs on these arms dip into the scouring solution and move the wool from bowl to bowl through a series of squeeze rolls. The wool is dried and rebaled in preparation for the next process, or, if necessary, it is carbonized. Carbonizing is a process of removing vegetable matter such as straw, burs, and grass by steeping the wool for a short time in a dilute sulfuric acid solution followed by drying at a high temperature to dehydrate and char the vegetable matter. The stock is passed through a beater which brushes out the charred vegetable matter. The wool is then dipped into a neutralizing bath and redried.

SPINNING——Dry wool is sprayed with an emulsion of oil and water as it passes over a conveyor belt. It is then carded and spun into yarn.

DYEING——The process of applying color to wool involves a variety of steps. Wool may be dyed in any of three forms: loose fiber, yarn, or piece goods. The processes are nearly the same. The wool is put into a vat or dye kettle, commonly wood or stainless steel. The kettle is filled with water; salt, acid, and dye are dissolved, added to the kettle, and the material boiled for about an hour. The exhausted dye solution is run off, and the material is rinsed and dried. Several variations of this dyeing process are used depending upon the service to which the goods will be put. The above describes the most commonly used "acid dyeing" process. There are, in addition, neutral dyeing, which uses practically no acid; chrome dyeing in which the color is mordanted onto the fiber for best wash fastness; and metalized dyeing which uses a strong acid solution.

Dyehouses commonly carry out certain auxiliary processes connected with the coloring. Among these are scouring of yarn and piece goods to remove spinning oil, which would otherwise cause a resist to the adsorption of dye. To correct errors in dyeing and changes in orders, stripping of color from wool to prepare for redyeing another shade is often done. Stripping involves the use of a reducing

* This article is being published in booklet form as Publication No. 438, Public Health Service, Bureau of State Services, Division of Sanitary Engineering Services, U S Department of Health, Education, and Welfare. Publication No. 438 will be the third of a series of Industrial Waste Guides prepared by the National Technical Task Committee in cooperation with the Public Health Service.

agent in an alkaline or slightly acid solution, depending on the particular reducing agent.

WEAVING AND FINISHING——Since weaving is a dry process, not producing liquid wastes, it is not of particular concern in the prevention of water pollution.

Finishing applies most particularly to piece goods. The first step in finishing is fulling, in which piece goods are soaked in a soap solution and put through a series of roller mills until they become felted and shrunken to increase their body and density. The goods are then put through a washer to remove soap and emulsified spinning oil. They are then dried and are ready for dyeing or cutting.

There are many integrated mills which, within one large building, carry out all of the processes described above.

THE POLLUTING EFFECTS OF WOOLEN MILL WASTES

THE MEANING OF "POLLUTION"——Water is said to be polluted when its character is changed, by addition of materials or in any other manner, in such a way that the usefulness of the water is reduced.

In their natural state, most bodies of surface water and flowing streams are relatively clear, colorless, and contain several parts per million of dissolved oxygen which is supplied by absorption from the air and to some extent by plant life in the water. The dissolved oxygen in the water is as necessary for the existence of fish and many other desirable kinds of life in the water as the oxygen in air is for the existence of man and animals on land. Clarity of the water permits the transmission of light which retards undesirable bacterial growth and generally contributes to a healthy and balanced population of aquatic organisms. Fresh waters in this kind of environment are usually suitable for most uses—as a source of municipal and industrial water supplies, for recreational bathing and fishing, irrigation, etc.

Pollution represents any undesirable departure from the condition described above. It can occur naturally as well as artificially. The most common form of natural pollution occurs when rains wash dirt from uncovered ground and heavy streamflows stir up the bottom. The stream is thus polluted by muddying, which may destroy animal and plant life on the bottom, reduce fish populations, and render the water less suitable for many beneficial uses. Land-use practices of man contribute greatly to this form of pollution. Another source of natural pollution is the leaching of excessive quantities of salts or harmful materials from the formations over and through which the water flows. The alkali waters of the Southwest are examples of this type of pollution.

Manmade pollution results chiefly from the discharge of wastes from cities and industries. Domestic wastes are relatively uniform in composition and in their effect on streams. Methods of treating municipal sewage are fairly standard. Therefore, wastes from the plant's sanitary facilities can usually be discharged to public sewers without special concern to the plant operator.

In contrast, industrial wastes vary widely in character and in their polluting effects; therefore, each type of waste is a special waste-treatment problem.

Most organic substances undergo a more or less gradual chemical or biological change which takes dissolved oxygen from the water. The extent of oxygen depletion depends on the rate of this oxygen demand in relation to the reaeration characteristics of the stream. If the dissolved oxygen is reduced below certain limits, desirable fish and aquatic life cannot exist. Complete removal of dissolved oxygen results in a septic stream which is characterized by obnoxious odors, floating solids, and a generally disagreeable appearance. Suspended organic solids may deposit on the bottom of quiet areas in the stream, concentrating the oxygen demand of these wastes in those areas. Waters containing considerable organic material are generally unsuitable for municipal and industrial water sources, recreational and some agricultural uses.

The introduction of disease organisms or harmful bacteria into the stream is another form of pollution which is particularly harmful to uses such as drinking-water sources, recreation and bathing. Sewage is the principal cause of this type of pollution.

Excessive concentration of soluble inorganic salts generally renders water less suitable for industrial and municipal water sources. Concentrations of sodium and boron salts above certain limits cannot be tolerated in irrigation water. A serious disadvantage of this type of pollution is that soluble inorganic salts are not usually removed by natural stream purification processes; therefore they may affect use of the water far downstream from the point of entry. Acids and alkalies react to form salts and in addition have corrosive effect on boats and structures in contact with the water.

A number of substances are toxic to fish and aquatic life. Many of the metals which may be present as salts fall in this category. The acids, alkalies and numerous members of other classes of compounds may have similar effects. Some substances are toxic to humans also, if present in sufficient concentration in water supplies.

The pollution may be in the form of the addition of tastes, odors, and color to the water. Phenol is an example of pollutant which results in serious taste problems in drinking water supplies. Color in itself is esthetically objectionable, particularly in drinking and recreational waters. Some industrial process waters must also be free of color.

Suspended inert matter may also have detrimental effects on the utility of the stream. It makes the water turbid, reduces light penetration and much of it eventually settles on the bottom. The turbidity increases the cost of treatment required for municipal and industrial uses. Deposits on the bottom may harm bottom-dwelling aquatic life, reduce the carrying capacity of the stream channel, and shorten the useful life of reservoirs. There are instances in which the deposition of industrial wastes has increased the dredging necessary to maintain ship channels.

Listed in Table I are some of the principal polluting effects of certain types of materials frequently present in industrial wastes.

Woolen-mill wastes, like many other industrial wastes, normally contain several of these kinds of polluting materials, and therefore may have a number of detrimental effects on the stream. For instance, wool scouring wastes can render a stream turbid and alkaline and remove all of the

TABLE I
POLLUTING EFFECTS OF SOME INDUSTRIAL WASTE COMPONENTS

Polluting agent	*Effect*
Acids, alkalies, and inorganic salts.	Toxic to fish and aquatic organisms. Deteriorate boats and structures in the water. Detrimental to municipal, industrial, and irrigation uses.
Dyes.	Add color which is esthetically objectionable in drinking and recreational waters.
Inert matter, such as pigments, clay, coal dust, etc.	Adds turbidity, settles on stream bottom. Reduces desirable fish population. Increases municipal and industrial water treatment costs. Interferes with navigation and may reduce useful life of reservoirs.
Organic matter, including organic oils, greases, and salts.	Depletes dissolved oxygen, eliminating desirable fish populations. May add tastes, odors, and turbidity detrimental to industrial and municipal water supplies. Forms floating scums esthetically objectionable and harmful to recreational uses such as bathing.

TABLE II
PROPERTIES OF WOOLEN-MILL WASTE SOLUTIONS

Waste	*Gallons waste per 1,000 lbs clean wool*	*BOD of waste ppm*[1]	*Composition (%)*	*pH*	*Color*	*Odor*
Wool scouring	8,000	6,000 to 10,000 *(29, 13, 37)*	0.5 wool grease 0.5 suint salts, grit, burs 0.1 alkali	10.2	brown	foul
Acid dyeing	2,000	400 to 4,000 *(48)*	0.1 mineral or organic acid 0.2 salt	4.0	variable light to strong	slightly acid
Carbonizing	500	20 to 50	5 sulfuric acid	1.0	none	acrid
Piece or yarn washing	5,000	210 to 350	0.2 spinning oil 0.1 alkali 0.05 soap	9.5	light brown	soapy

[1] BOD = Biochemical Oxygen Demand, a term which signifies the amount of oxygen which will be taken out of the water in the decomposition and stabilization of the waste. The value given in the table is the number of parts by weight of oxygen used per million parts of waste in 5 days at a temperature of 20° C.

available oxygen. If this is allowed to happen, fish are killed, and the stream gives off obnoxious odors formed by the septic decomposition of the emulsified greases and other organic constituents. Dye wastes together with the salt and acid in them create almost all of the above effects except turbidity.

POLLUTING EFFECTS OF SPECIFIC WOOLEN-MILL WASTES——We shall now examine the polluting effects of individual woolen-mill waste solutions. The following table lists the polluting characteristics of the major wastes. The data were taken from a number of references and represent average values around which considerable variation can be expected from mill to mill. These differences arise from corresponding differences in the grease content of various wools, and differences between mills in the water-to-wool ratios in dyeing or scouring.

Table II gives the characteristics of the individual wastes. The stream usually receives a mixture the composition of which depends on the relative amounts of the individual types present. In one mill, for instance, the total output consists of 20 percent wool scouring waste, 30 percent dyeing waste, 30 percent yarn washing waste, and 20 percent from all other sources, including water softener backwash and sanitary facilities. A plant which is primarily a scouring and carbonizing plant will have a waste that differs greatly from that of a dyeing and finishing plant.

Many studies of woolen wastes have been undertaken. One of these, conducted at Lowell Technological Institute (*46*), evaluated the manner and extent to which wool scouring liquors contribute to stream pollution. Various methods of treatment were surveyed, and it was determined that control of the scouring process played an important part in the amount of pollutional materials discharged.

Another report by Baity (*2*) showed that textile wastes have three primary bad effects on the streams which receive them:

1) They are toxic to stream life.

2) They deplete the oxygen in the water.

3) They impair the stream's physical characteristics and properties.

This report reviews waste-treatment accomplishments in the State of North Carolina.

England has had a severe problem from wool scouring wastes since long before wool processing became a major industry in this country. Barker (*3*) has noted that the Yorkshire area scours out 34,000 tons of fat, 33,000 tons of dirt, and 11,000 tons of suint salts per year, most of which end up in the rivers. Toward the end of the last century, the putrefaction of these wool scouring wastes evolved so much hydrogen sulfide gas that it was possible for the air above the water to burn. The Yorkshire Rivers Board has conducted detailed studies (*1*) on the causes of pollution, covering nontechnical phases such as the use of rented manufacturing facilities, the contract processing of waste, the use of joint outlets by several mills, etc.

How badly the receiving body of water will be polluted also depends on the amount of water available for dilution. Wastes from the largest textile mill, if mixed in the ocean, would not affect the quality of such a large quantity of water. Unfortunately, most textile plants haven't an ocean nearby but are located on streams with limited flows. This creates the need for waste control.

A large river can assimilate more wastes than a small one; wastes which cause no pollution problem in times of high stream flow may cause serious conditions during periods when the stream is low. The mill operator should know the average, high, and low flow rates of the stream into which the mill wastes discharge in order to determine how much must be done to prevent pollution under all conditions.

METHODS OF DEALING WITH WOOLEN-MILL WASTES

When a woolen-mill operator is confronted with waste problem, he should consider four steps:

1) *Waste saving*: Waste can be reduced at the source by carefully controlling the manufacturing process. A simple example is the use of the least amount of acid in dyeing that will satisfactorily do the job, in order to minimize the amount of acid that finally gets out into the waste.

2) *Byproduct recovery*: Many mills have contaminated streams with wastes which, on investigation, were found to contain salable byproducts. The most common example in the woolen industry is wool grease.

3) *Combined treatment with municipal sewage*: In communities that have adequate municipal sewage treatment facilities, it may be feasible to discharge the woolen-mill effluent into the municipal sewerage system. This approach frequently requires no capital outlay and can generally be paid for on a sewer rental basis.

4) *Treatment of residual waste*: After everything possible has been done along the lines of the first three steps above, the final recourse is to treat the remaining waste to the extent required by the receiving stream. A number of treatment methods are available.

Each of these steps is discussed in the sections which follow.

With a planned program based on these four steps, almost any industrial waste can be satisfactorily disposed of without creating a stream-pollution problem; and among industrial wastes, woolen-mill wastes are not by any means the most difficult to handle. Now let us look at each of these four steps.

WASTE SAVING——Logically, the first step in preventing stream pollution is to eliminate avoidable waste by careful control of production operations and to modify processes so that less harmful substances are in the plant effluent. Among industrial waste control people, much of this comes under the heading of good housekeeping economy, and almost invariably results in saving money. Some very fine investigations have been made of this approach in the textile industry.

1) Masselli and Burford (*29*) studied

in detail the processing at two woolen mills and reached the following conclusions:

a) Many synthetic detergents have a much lower BOD than soaps and the use of any of several detergents in place of soap could lower the oxygen demand load contributed by a woolen mill from 30 to 45 percent.

b) Mineral acids and ammonium sulfate have much lower BOD than acetic acid. The substitution of the former for the latter in dyeing can reduce the BOD of the plant effluent from 2 to 15 percent.

2) Snyder (*55*) has reported that the polluting effect of cotton slashing waste can be greatly reduced by using certain synthetic compounds like carboxymethylcellulose as a partial or total replacement for starch.

3) Stafford and Northup (*56*) made comparative BOD tests on about 175 textile chemicals and dyes. From this list, many suggestions can be taken along the lines of materials changes that can improve the characteristics of a woolen mill effluent.

The above are examples of material substitution. Equally fruitful is the field of material economy without necessarily changing the materials used. For instance, one mill which scoured as much as 400,000 pounds of wool per week changed its method of alkali control from conductivity measurements to titration and, by the more accurate metering of alkali into the washers, cut its soda-ash consumption from 10-12 pounds per hundred pounds of wool down to 4. Spaced over the period of a year this resulted in a saving of several thousand dollars and cut the alkali in the effluent almost two-thirds. The same has been shown to be true in acid dyeing; pH control in the dyehouse can be used to minimize the amount of acid put into the dye kettles, thus keeping to a minimum the amount of acid in the effluent.

Souther (*57*) has shown that the amount of reducing agent added in vat dyeing is usually in excess of what is actually required and that careful control can produce perfect results with greater economy of material. Since reducing agents have a tremendous oxygen consumption, this can be a very important point for mills which use a large quantity of vat dyes. In this connection, the Marhen process offers a good tool for controlling reducing agent through the measurement of redox potential.

BYPRODUCT RECOVERY——Whether an industrial waste is put into a municipal sewer system or treated at the plant and put into surface waters, the recovery of usable or salable materials from the waste lessens the degree of treatment necessary and generally reduces the cost of manufacturing operations. Byproduct recovery is economically justified when the value of the byproducts plus the reduced treatment costs exceed the cost of recovery.

In the case of woolen mills, there are presently few items which could possibly be recovered. These are wool fibers, wool grease from scouring operations, and fertilizer material from scouring operations. Research now going on may result in cheaper ways of recovering other materials now considered too costly to recover, and may find markets for other components of the waste which today are considered valueless.

The separation of wool fiber from waste is a relatively simple matter. Vibrating screens of a readily available standard design are in use for this purpose. Such vibrating screens are common chemical engineering equipment. Another technique involving a filter drum is described in a German publication (*4*). Wool fiber disintegrates slowly and therefore has a very extended period during which it will absorb oxygen slowly from water. It has a more acute disadvantage of clogging pipes and sewage-treating equipment if the waste is put into a municipal sewer system. The recovery of short fiber is a distinct economic advantage since short fiber can be added to wool mixes in certain percentages.

There is a large body of information and experience on the recovery of wool grease from wool scouring solutions, and there are several techniques for recovering the grease, all of which work successfully. Wool scouring wastes are the strongest polluting materials in the whole textile industry and the major factor to be considered in dealing with a waste problem at an integrated woolen mill.

In addition to reducing the required residual waste treatment, the chief incentive for recovering grease is its salability, which has permitted profitable recovery in the last 7 or 8 years. Prior to this period, however, the wool-grease market has been noted for wide fluctuation in price and there is relatively little confidence even today in the steadiness of price for the recovered wool grease. The Department of Agriculture is conducting research (*36*) designed to broaden the usage of wool grease, lanolin, and the components thereof. Another Department of Agriculture laboratory project (*25*) involves a solvent scouring system in which not only the grease but the suint salts can be recovered. A report on this project has been made by its head, Harold Lundgren. In this case, a completely new system of scouring is involved. A market must be developed for recovered suint salts in order to justify the process economically.

Details on the standard methods for grease recovery are available from many sources (*5, 7, 13, 14, 18, 20, 22, 38, 39, 40, 50*). These standard methods are based on two principles:

1) Continuously circulating the scouring solution through centrifugal extractors to remove amounts of wool grease in excess of a certain threshold concentration. The extracted scouring solution is returned to the scouring machines for buildup of grease concentration and cycled again through the extractors.

2) The entire scouring solution is treated in a batch process of chemical precipitation such as by acid cracking or the addition of calcium salts to separate out the grease. The separated crude grease is then put through a filter press to remove solids, and is dried.

The relative amount of grease compared to the other polluting materials such as suint salts, dung, urine, dirt, grit and burs in the scouring waste depends on the type of wool being processed. The grease will account for about 30 percent of the oxygen required (BOD) by waste from the scouring of high grease content clothing wool. Sixty percent of this grease can be removed by centrifugal extractors. This will reduce the oxygen demand by 48 percent or approximately one-half.

The centrifugal extraction process removes a smaller proportion of the grease from low grease content waste. It is therefore a much less effective pollution reduction measure in plants processing low grease content wools.

Grease represents about one-half the oxygen demand in wastes from scouring low grease content carpet wools. The acid cracking process will remove practically all of this grease, which in turn reduces the oxygen demand of such scouring wastes by one-half.

The process for grease recovery requires a considerable capital investment, not less than $35,000; but if any volume of greasy wool is processed, the installation can be amortized in less than 5 years.

After the grease is recovered, there are two remaining components: the filter press cake which contains considerable organic matter, dirt, and grit; and the water phase of the scouring solution. The press cake can easily be dried by spreading out on the ground, and makes a good fertilizer. The water effluent is still not satisfactory for putting into a stream of high water quality and must be treated in any of several ways discussed later.

Two systems for solvent scouring have been tried with a view toward eliminating the stream pollution problem by reducing the amount of aqueous treatment given to wool in its lengthy processing through a woolen mill. Neither process is in use today. The first and oldest is a batch process for degreasing wool in a kier by

circulating naphtha solvents through it. The naphtha with grease dissolved in it (55) was then filtered and the solvent evaporated and recovered. The second process was described by Oberholtzer (32) and consisted of a continuous scouring with trichlorethylene. The processes fell into disuse because of the following disadvantages:

1) The sale value of the recovered grease from a solvent process is not as great as from an aqueous scouring, since it is darker in color and contains foreign matter which is difficult to remove.

2) Inevitable solvent losses add a cost factor to the process which renders it noncompetitive to aqueous scouring.

3) In spite of the solvent scouring, there remained in the wool other foreign matter such as listed above which had to be scoured out in an aqueous medium after the solvent degreasing. This immediately restored the stream pollution problem, although not as severe as if the degreasing had not been done.

COMBINED TREATMENT WITH MUNICIPAL SEWAGE———After setting up good housekeeping practices and any possible byproduct recovery so as to minimize waste at the source, the next possibility for mills suitably situated is to consider putting the plant effluent into the city or town sewerage system. This procedure usually involves the least capital investment. However, it must first be determined whether the nature of the waste will interfere with the sewage treatment and whether local arrangements can be made to dispose of the waste in this manner.

Several studies have been made to determine the effects of textile-mill wastes on sewer systems. It has been concluded that if certain conditions are satisfied, woolen-mill waste can be added to sewer systems. The factors which must be considered are:

1) Is the volume of mill wastes large or small in relation to the amount of sewage?

2) What are construction materials in the sewer lines, and will the mill wastes be harmful to the sewer lines or the joints between sections of sewer pipes?

3) How is the sewage treated, and will the addition of mill wastes overload or upset the operation of the municipal treatment plant?

4) If some treatment is needed to make the plant effluent suitable for discharge to municipal sewers, is such pretreatment feasible?

5) Assuming all these conditions to be favorable, what would be the cost for utilizing city sewer systems to dispose of woolen-mill wastes?

The following paragraphs review the findings of some studies that were made in an attempt to answer the questions above.

1) The oldest reference (45) describes a study in 1923 of a small German town, population 7,000, where they successfully combined with the sewage large amounts of waste from woolen mills which scoured raw stock, dyed, spun, and finished woolen cloth. In this case, the sewage treatment processes (circulation on long, shallow sand beds, Imhoff tank, sludge drying beds) were a type for small cities only and the quality of the final effluent would not be adequate for all purposes.

2) Rudolfs reported in 1937 (35) on laboratory and pilot plant studies of the effect of a number of trade wastes on high (70° C) and low (20° C) temperature sewage sludge digestion processes. The results of the tests with woolen-mill wastes generally indicated—

a) The addition of 10 percent by volume of wool scouring waste to digesting sewage sludge had relatively little effect, but the addition of 20 percent retarded digestion.

b) The addition of 10 percent dye wastes reduced gas production up to 35 percent.

c) After a short period of continuous addition of the wastes the bacteria of the digestion process became adapted to the wastes to the extent that digestion of the above concentrations proceeded satisfactorily.

3) Geyer (16) reports that in his opinion the best method of industrial-waste disposal is combination with municipal sewage. He describes methods for chemical precipitation, filtration, and biological purification. This work included wool scouring and dye wastes.

4) In Los Angeles (34) wool scouring wastes were combined with sewage, but the sulfide content of the scouring waste caused odor nuisances and the oxidation of the hydrogen sulfide damaged concrete pipe joints in the sewers. The problem was overcome by reusing the rinse water in the scouring solution and treating the rest of the waste with ferrous sulfate. In this way, sodium sulfide was recovered, the sale value of which exceeded the cost for its recovery.

5) One other reference gives an excellent summary of the whole situation. A report from the Textile Foundation (42) discusses the pros and cons of putting textile-mill wastes into domestic sewer systems. The general conclusion is that it can be done providing certain principles are observed. These principles are—

a) That the waste be made consistent in its character.

b) That the rate of feeding the industrial waste into the sewer system should be controlled to maintain a relatively constant ratio of waste to sewage.

The case of one large plant which used this procedure can be cited. The woolen mill scoured and dyed 300,000 pounds per week and put the waste into the sewer system of a community of about 80,000 people. It was found that with usual dumping of the equipment at the end of the day, large amounts of highly concentrated wastes would reach the sewage disposal plant and exceed the capacity of its chlorinating equipment. The problem was solved by the construction at the woolen plant of a large concrete pit, capable of handling all of the plant effluent for 1 day. In this pit the dye wastes and scouring wastes partially neutralized each other, and a great deal of the suspended matter settled to the bottom. A sluice was opened after the pit was filled so as to drain the pit slowly and uniformly into the sewer system over a 12-hour period, and the city sewage treatment was not adversely affected.

An excellent survey has been written by Schroepfer (58) in which he describes the various techniques for determining fair sewage service charges for industrial wastes. There are a number of methods by which an industrial corporation can pay the additional cost incurred by a city in handling their wastes in combination with sewage. Naturally, the additional measures to be taken to handle these wastes are dependent upon the nature and volume of the waste in relation to the equipment, daily sewage volume, and the nature of the treatment at the municipal sewage plant. Hazen (51) has also summarized the problems concerned with evaluating industrial wastes for the determination of sewer service charges.

TREATMENT OF RESIDUAL WASTES———This section describes the techniques that may be used for dealing with the residual effluent after all of the avenues that we have discussed above are explored. If this effluent is put into the municipal sewer system, nothing of course need be done. If, on the other hand, it is put into surface waters, some further treatment may be necessary. The nature and extent of this treatment will depend upon stream conditions and the uses to which the water will be put. Requirements established by State and local governing authorities are not the same in all areas and must be determined for each case.

There are two references which summarize the laws in existence on water quality standards and water pollution abatement (52, 54). Since many pollution abatement laws are of recent origin, the development of this type of legislation is to some extent experimental. Equally important to the words of the laws, therefore, are the interpretations

given by the administering authorities. For this reason, it is vitally important in arranging for the disposition of an industrial effluent that the plant management be in contact with the agency administering the local laws that govern waste disposal.

Woolen-mill wastes can be treated in a variety of ways so as to reduce turbidity, dissolved solids, acidity or alkalinity, oxygen depleting components, color, and bacterial content. The prior sections have discussed all of the steps that may be taken to recover useful material and to eliminate waste at the source. It is therefore the aim of the processes discussed here to achieve their purpose at the lowest possible cost, since these treatments are a net expense from which no return can be obtained. Fortunately, many of the treatments used employ very low cost chemicals.

It is a general premise that, where a mill produces more than one kind of waste, it is easiest to combine the various kinds of wastes and treat the combination as one. This reduces the number of treating units and usually results in handling a more uniform raw material. An integrated woolen mill will have as its major waste components the dyehouse effluent and the wool scouring effluent. As noted in a previous section, these wastes, if combined, partially neutralize one another. We will first consider what can be done if this practice is followed. We will then observe briefly how treatment differs in the case of mills which have only dyehouse effluent or only scouring effluent.

Some of the literature (*11, 21, 40, 47*) deals with practices for the treatment of industrial wastes in general, which include textile wastes.

Droszdorf (*11*) surveyed the situation as early as 1923 and noted that woolen-mill wastes can be purified by simple chemical means such as coagulation with lime and ferrous sulfate. He concluded that biological means such as digesting systems and trickling filters offered the only method for complete purification.

Kuni and Platonova (*21*) studied chlorination as a method for purifying textile-mill wastes and noted that this precipitates much of the suspended and dissolved organic matter.

The Connecticut State Water Commission summarized industrial waste research in 1948 (*40*) and determined costs for treating woolen-mill wastes with alum, iron, sulfate, and chlorine. They noted that, as an average, the treatment of woolen-mill effluents can be done for 15 to 25 cents per thousand gallons.

Weston (*47*) described the characteristics of woolen-mill wastes in 1939 and enumerated the principles for systematic treatment:

a) Equalization of flow.
b) Wool-grease recovery.
c) Chemical precipitation.
d) Drying the sludge which results from the precipitation.
e) Biological treatment of the clear liquor resulting from the chemical precipitation.

Other literature (*9, 10, 12, 17, 33*) deals solely with textile wastes.

Coburn (*9*) describes a process for treating woolen-mill wastes in which the various departmental effluents are composited in sedimentation tanks, where sulfuric acid and alum are added to adjust to a pH of 6. This process precipitates out most of the solids which are then run off to sludge drying beds and sand filters. A clear, almost colorless, effluent is obtained.

Eldridge (*12*) reported in 1942 that 83 percent removal of suspended solids and 72 percent removal of BOD was accomplished by dosing a woolen-mill waste with 1 pound of lime and 3 pounds of ferric chloride per thousand gallons of waste. The characteristics of the sludge and effluent are described.

Coburn and Oberholtzer (*10, 33*) describe the system used at a carpet mill, similar to those described above. In this case, however, the effluent is put into small artificial lakes to permit a longer sedimentation period and absorption of oxygen from the air. The use of lagoons presupposes the availability of adequate land area, usually several acres for the average-size mill.

Goldthorpe (*17*) reviewed in 1946 a description of textile-waste disposition, which describes biological treatment, sludge treatment, and pressure filters.

McCarthy reported in 1950 (*26*) that woolen-mill wastes can be treated on trickling filters if pH is suitably adjusted. He noted that wool dye wastes are stronger than domestic sewage, and wool scouring wastes still stronger in their pollution effects.

Since wool scouring wastes are the most concentrated in the textile industry, considerable effort has been given to the disposition of this effluent alone (*6, 8, 27, 28*). Campanella (*6*) worked out a process for precipitating wool scouring wastes with calcium hypochlorite and adapted this to a continuous process. He notes that the results in terms of solids and BOD removal are excellent.

Coburn (*8*) compared three methods for the treatment of wool scouring wastes; acid-cracking, calcium hypochlorite and calcium chloride with carbon dioxide. He found the chemical cost for the first to be cheapest and the second most expensive, and all gave a solids removal better than 85 percent and a BOD removal better than 42 percent. He nevertheless found that the residual BOD after treatment is higher than domestic sewage and, to be reduced, requires treatment through trickling filters.

McCarthy (*27, 28*) studied the application of calcium chloride and carbon dioxide for the precipitation of scouring waste and obtained very similar results.

If dyehouse wastes alone are involved, the treatment must be different. The waste is acidic, contains very little suspended matter, and may be highly colored. In some cases, chlorination removes the color. A method more recently developed is the filtration of the waste through a bed of activated carbon. The carbon absorbs the color from the solution and can be regenerated and used over and over again. Fassina (*15*) recorded a forerunner of this treatment in 1937. He suggested neutralizing the acid in the dye waste with lime and then passing the solution through a porous material such as acid-treated wool to absorb colored impurities. He determined that this purifies the waste to the degree that it is no longer injurious to fish life.

Thornton and Moore (*43*) reported in 1951 that Fuller's earth and activated bauxite are good absorbents for dyestuffs from waste water.

Thatcher (*44*) described an automatic method for acid neutralization, whereby a lime slurry was fed into a continuous stream of acid waste, controlled by an automatic pH control unit.

Zack (*48*) showed that lime and ferrous sulfate coagulation remove 70 percent of the BOD in dye waste. If this waste is then lagooned, the BOD removed is better than 92 percent.

Sterling (*53*) notes that, to reduce the BOD of acid dye wastes, the wastes can be treated by trickling filters.

SUMMARY AND CONCLUSION

Controlling stream pollution has become an urgent necessity in the United States today. Our demands for usable water for public water supplies, industrial uses, and other beneficial purposes are now so great that we must reuse the same water many times as it flows from city to city. Pollution can prevent or add greatly to the cost of many water uses. For this reason, the wool-processing industry, like other industries, is giving greatly increased attention to reducing the polluting effects of its wastes.

This Guide summarizes the sources of pollution in the wool-processing industry, the polluting effects of woolen-mill wastes, and information on the methods of dealing with the waste problems of the industry. Four separate operations of the industry produce liquid wastes: opening and scouring, spinning, dyeing, and finishing. Significant polluting characteristics

of these individual wastes include oxygen demand, suspended solids, acidity, alkalinity, color, and grease.

The polluting effect of the wastes may be reduced by substituting detergents for soap, mineral acids for acetic, synthetic compounds for starch, and similar changes. Limiting the amounts of acids, bases, and reducing agents to the actual requirements for the process also will reduce waste loads. Wool fibers, wool grease, and fertilizer material all may be recovered from the wastes. The wastes may be treated in combination with domestic sewage, or they may be treated by 1) coagulation and precipitation with chemicals, 2) chlorination, 2) biological processes, and 4) absorption.

The information contained in this Guide can help the mill supervisor carry out his increasing responsibility to reduce the polluting effect of the mill wastes. Much can be accomplished through good housekeeping procedures which also reduce operating costs. The plant chemist and engineer can be most helpful in developing further measures.

REFERENCES CITED

(1) Anon, "West Riding Rivers and Trade Effluents", *Engineering* 93, 497-499, 569-570, 690-691, 739-740, 795-798.

(2) Baity, H G, "Textile Waste Treatment", *Am Dyestuff Reptr* 27, 544-547 (1938).

(3) Barker, A F, "Yorkshire Rivers Purification—Wool Manufacturer's Problem", *J Textile Sc* 2, 97-99 (1928).

(4) Bublitz, "The Removal of Suspended Matter From the Wastes of Woolen Mills by Babrowskis Filter Drum", *Soziol Technik* 11, No. 7; *Wasser u Abwasser* 6, 217-219.

(5) Cameron, A A, "Recovery of Grease From Wool Scouring Waste and Abatement of Stream Pollution Through the Calcium Hypochlorite Process", *Am Dyestuff Reptr* 39, 667-668 (1950).

(6) Campanella, J L, "Hypochlorite Treatment of Wool Scouring Waste—A Discussion", *Sewage Works J* 19, 255 (1947).

(7) Cherkinskii, S N, and Leites, L G, "Purification of Waste Water From Wool Washing With Recovery of Fat", *Vodosnabzhenie Sanit Tekh*, No. 11-12, 76 (1939).

(8) Coburn, S E, "Comparison of Methods for Treatment of Wool Scouring Wastes", *Sewage Works J* 21, 84-90 (1949).

(9) Coburn, S E, "Improvements in the Operation of a Textile Wastes Treatment Plant", *ibid* 1, 77-79 (1928).

(10) Coburn, S E, "Modern Wastes-Treatment Plant for Carpet Mill of James Lees and Sons at Glasgow, Virginia", *Water & Sewage Works* 97, 167-171 (1950).

(11) Droszdorf, W, "Wastes from the Textile Industry in Russia", *Gesundh Ing* 46, 167-168 (1923).

(12) Eldridge, E F, "Report of Experimental Studies and Recommendations for Waste Treatment at Yale Woolen Mills," *Michigan Eng Expt Sta* No. 96, 3-18 (1942).

(13) Faber, H A, "The Hypochlorite Process for Treatment of Wool Scouring Wastes and Recovery of Wool Grease", *Sewage Works J* 19, 248 (1947).

(14) Faber, H A, "Wool Scouring Wastes Treated by New Chemical Process", *Water & Sewage Works* 93, 467 (1946).

(15) Fassina, L, "Purification of Waste Waters —1. Dye Houses", *Chimie & Industrie* 38, 840-847 (1937).

(16) Geyer, J C, "Industrial Wastes: Textile Industry", *Ind Eng Chem* 39, 653-656 (May, 1947).

(17) Goldthorpe, H H, "How Huddersfield Tackles the Treatment of Textile Wastes", *Synthetics & By-Products* 8, 185-189 (1946).

(18) Hillier, W H, and Campbell, S G, "Recovery and Processing of Wool Grease", *ibid* 8, 329 (1946).

(19) Jacobs, H L, "Neutralization of Acid Wastes", *Sewage Ind Wastes* 23, 900-901 (1951).

(20) Kelsey, W, "Recovering Fats From Waste Waters", Brit Pat 123,848 (Mar 14, 1918).

(21) Kuni, V E, and Platonova, M N, "Chlorination as a Method for the Purification of Waste Waters", *Vodosnabzhenie Sanit Tekh* 9, 64-69 (1937); *Khim Referat Zhur* 6, 81 (1938).

(22) Leites, L G, "The Purification of Waste Waters and the Recovery of Lanolin From the Washing of Wool", *Sherstyanoe Delo* 18, No. 8, 13-15 (1939); *Chem Zentr* 1, 3438 (1940).

(23) Ludwig, H P, and Ludwig, R C, "How To Flocculate Greases So They Won't Clog Sewers", *Aug News-Record* 147, No. 1, 40 (1951).

(24) Lumb, C, and Barnes, J P, "Precipitation of a Trade-Waste Sewage", *J Proc Inst Sewage Purif* 82-92 (1940).

(25) Lundgren, H, "Alcohol Abstraction of Wool Scouring Wastes", *Textile Research J* 21, 540-555 (1951).

(26) McCarthy, J A, "Characteristics and Treatment of Wool Dyeing Wastes", *Sewage Ind Wastes* 22, 77-86 (1950).

(27) McCarthy, J A, "Use of Calcium Chloride in the Treatment of Industrial Wastes", *ibid* 24, 473-479 (1952).

(28) McCarthy, J A, "Method for Treatment of Wool Scouring Wastes", *Sewage Works J* 21, 75-83 (1949).

(29) Masselli, J W, and Burford, M G, "Pollution Sources in Wool Scouring and Finishing Mills and Their Reduction Through Process and Process Chemical Change", New England Interstate Water Pollution Control Commission (June, 1954).

(30) Mauersberger, H R, and Von Bergen, W, "American Wool Handbook", Textile Book Publishers (1948).

(31) Merryfield, F, "Industrial Wastes in Willamette Valley", *Civil Eng* 6, 682-684 (1936).

(32) Oberholtzer, R E, "Continuous Solvent Scouring of Domestic Wool", *Textile World* 99, 103-107, (1949).

(33) Oberholtzer, R E, "Treatment of Carpet Mill Wet Processing Waste Liquors," *Textile World* 99, 103-107 (1949).

(34) Rawn, A M, "Sulfide Wool Wastes Endanger Sewer System", *Sewage Works Eng Munic Sanit* 16, 491-493 (1941).

(35) Rudolfs, W, and Setter, L R, "High and Low Temperature Digestion Experiments —III. Effects of Certain Organic Wastes", *Sewage Works J* 9, 549-586 (1937); Rudolfs, W, "Effect of Trade Wastes on High and Low Temperature Digestion", *Ind Eng Chem* 29, 803-804 (1937).

(36) Scanlon, J T, "Woolfacts", Wool Bureau, Inc.

(37) Singleton, M T, "Experiments on Anaerobic Digestion of Wool Scouring Wastes", *Sewage Works J* 21, 286-293 (1949).

(38) Snell, F D, "Chemical Treatment of Trade Wastes—V. Waste from Wool Washing", *Ind Eng Chem* 21, 210-213 (1929); *Chem Abst* 22, 1204

(39) Sokolov, V N, "Regenerating Fatty Substances From Waste Waters of the Wool Industry", *Sherstyanoe Delo* 4-5, 24-26 (1935).

(40) State Water Commission of Connecticut, "Industrial Waste Research", Public Works, 79, 19 (Feb, 1948).

(41) Stevenson, W L, "The Treatment and Disposal of Industrial Wastes", Chem Eng Congr World Power Conf (1936), Advance Proof No. F7, 24 pp.

(42) Textile Found Inc, "Textile Wastes—What Solution?" from "Textile Waste Treatment and Recovery", *Sewage Works Eng* 17, 16-17 (Jan, 1946).

(43) Thornton, H A, and Moore, J R, "Adsorbents in Waste Water Treatment-Dye Absorption and Recovery Studies", *Sewage Ind Wastes* 23, 497-504 (1951).

(44) Thatcher, H D, "Acid Neutralization Plant With Mechanical pH Control", *Inst Sug Purif J & Proc*, 161 (1943).

(45) U S Public Health Eng Abstracts E-637a, 52 (1928), "Experience With the Construction and Operation of the Purification Plant at Kettwig", *Technischen Gemeindeblatt* 31, 15 pp.(1928).

(46) Webber, H, "Study of Stream Pollution by Wool Scouring Liquors", *Bull Lowell Tech Inst* 14, 2 N (1950).

(47) Weston, R S, "The Treatment of Textile Wastes", *Sewage Works J* 11, 617-74, *Chem Abst* 33, 2218 (1939).

(48) Zack, S L, "Developments in the Treatment of Dyehouse Wastes", *Sewage Works Eng* 20, 129-130 (1949).

OTHER REFERENCES

(49) American Chemical Paint Co, "Centrifugal Concentration of Grease Emulsions From Wool Scouring Solutions", Ambler, Pa.

(50) Bogren, G S, "Disposal of Wool Scouring Wastes", Weston & Sampson, 14 Beacon St, Boston 8, Mass; Gibbs, F S, Inc, 2300 Washington St, Newton Lower Falls 62, Mass.

(51) Hazen, R, "Service Charges for Industrial Wastes Treatment", *Sewage & Ind Wastes* 26, No. 7, 830-835 (July 1954).

(52) R S Aries & Associates, "Industrial Water Pollution", Survey of Legislation and Regulations, 142 pp (1951).

(53) Sterling, C I, "Treatment of Dye Wastes by Trickling Filters", Lawrence Experiment Station, Mass Dept of Public Health.

(54) Feller, G, and Newman, J, "Industrial Waste Treatment", *Ind & Power* (June, 1951).

(55) Rhode Island Section (AATCC) Subcommittee on Stream Pollution Abatement, "The BOD of Textile Chemicals", *Am Dyestuff Reptr* 44, No. 11, P355 (1955).

(56) Snyder, D, "Cotton Slashing with Synthetic Compounds as a Means toward Pollution Abatement", *ibid* 44, No. 12, P382 (1955).

(57) Souther, R H, "In-Plant Process Control for the Reduction of Waste", *Am Dyestuff Reptr* 42, No. 20, P616-618 (1953).

(58) Shroepfer, G J, "Determination of Fair Sewage Service Charges for Industrial Wastes", *Sewage Works Management* 23, No. 12, 1493. (December 1951).

South Central Section——

RECENT DEVELOPMENTS IN THE DYEING OF DACRON POLYESTER FIBER AND NYLON*

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INTRODUCTION

SYNTHETIC fibers are part of the vast technological advancement which is giving the people of this country and much of the world a standard of living which was almost inconceivable even a few decades ago. These fibers have achieved this position of importance in our way of life not through utility alone, for in textiles, probably more than in most fields, aesthetic considerations are just as important as utility. The primary aesthetic requirement, color, was initially difficult to obtain because the new hydrophobic fibers did not appear to be compatible with the dyeing systems used for the hydrophilic natural fibers. However, through the cooperative efforts of the dyers and the dye and fiber manufacturers, new methods, new equipment, and new dyes have been developed so that it can now be said that the major difficulties are under control. In fact, frequently it is now a simpler job to dye a synthetic fiber than a natural one.

NEW LABORATORY DYEING EQUIPMENT

In order to investigate dyeing problems of these newer fibers, it was necessary to develop new equipment for use in the laboratory. It is often necessary to abandon the old dye pots for equipment which more nearly simulates that available in mills. While developed for the dyeing of synthetic fibers, this equipment finds much use in dyeing all types of fibers.

Figure 1 shows a battery of glass reflux tubes, which are extremely useful in dyeing at the boil. The assembly consists of large glass test tubes fitted with glass reflux condensers. These can be heated electrically or with gas burners. The boiling bath offers sufficient agitation to eliminate the necessity of hand agitation. The reflux condenser maintains a constant bath volume so that continuous addition of water to the bath is not required as in open-pot dyeings. Since the tubes are made of glass, it is possible to follow the exhaustion or other changes which may occur in the dye liquor. These tubes are useful in dyeing 1 to 20-g samples of fabric, yarn, or rawstock. Adapters for holding the various forms of fiber are shown in Figure 2. A support of Teflon polytetrafluoroethylene resin is used in dyeing skeins to avoid floating and tangling, and the stainless steel wire basket is used when dyeing rawstock.

Temperatures below the boil can also be maintained in these tubes by placing the system under a partial vacuum so that boiling occurs at 200°F, 180°F, or whatever temperature is desired. Manostats to regulate the vacuum are available commercially. Again, the boiling agitates the bath so that continual attention is not required.

For dyeing under pressure on this same scale, a pressure-dyeing machine has been developed (Figure 3). It consists of a battery of stainless-steel tubes which are tumbled in an atmosphere of steam maintained at any desired temperature up to 300°F. This machine was used rather than the type described by the Philadelphia Section (*1*) because its stainless steel construction simulates the materials of construction of mill-scale pressure dyers. In addition, the use of steam eliminates the dangers of handling hot fluids. Five-gram samples, which are suitable for shade matching or fastness determinations, are dyed in this machine.

For a larger scale dyeing of piece goods at atmospheric pressure, a laboratory beck, shown on Figure 4, is used. These becks are portable, requiring only an electrical connection for the reel motor and a burner for heat. They have been of great value, particularly in developing the methods for dyeing these newer fibers and their blends. From this type of ap-

H P Landerl

To aid in developing methods for dyeing the synthetic fibers, it has been necessary to develop new equipment for the laboratory. Examples of some of this equipment include reflux dyeing tubes, Du Pont tube pressure-dyeing machine, laboratory-size becks, Du Pont Jackson Laboratory package-dyeing machine, and the laboratory-size Barotor. The use of this type of equipment more nearly simulates mill conditions than does the use of conventional open pots.

A large amount of Dacron is dyed with the aid of carriers. The author presents a general review of carriers along with a more detailed discussion of the most commonly used carrier, o-phenylphenol. The optimum concentration of o-phenylphenol carrier for maximum exhaustion of dye is dependent upon a number of factors, but a general recommendation is made, both for dyeing Dacron and blends of Dacron and wool. The light fastness of light and medium shades of o-phenylphenol-dyed Dacron can be improved by removal of the residual carrier. This is best accomplished by a heat treatment. A new developed black for Dacron, which reduces the time for application of this type of color appreciably, has been developed.

A procedure for dyeing spun nylon carpeting with maximum penetration and levelness and with excellent fastness is accomplished by applying Capracyl dyes and other neutral dyeing dyes with Capracyl Leveling Salt, which is a leveling and transfer agent. Some filament nylon fabrics, particularly tricot, have been dyed with a minimum of barré, both at the boil and at elevated temperatures with acid dyes. Duponol D Paste surface-active agent acts as a leveling agent in both cases.

* Presented before the South Central Section on Feb 26, 1955 at the Hotel Patten, Chattanooga, Tenn.

NOTE: The names Acetamine, Capracyl, Celanthrene, Dacron, Duponol, Latyl, Naphthasol, Orlon, and Teflon are registered trademarks of E I du Pont de Nemours & Co, Inc, Wilmington, Del.

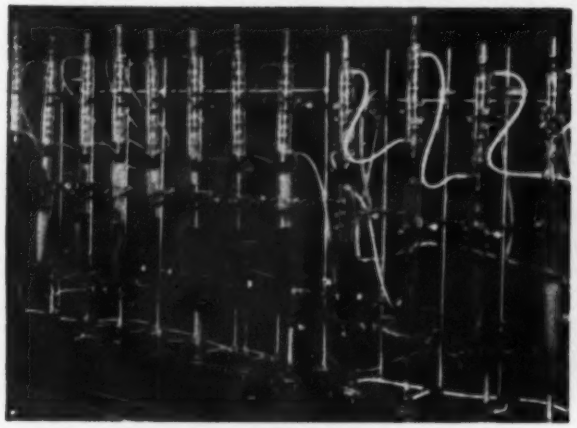


Figure 1
Reflux dyeing tubes

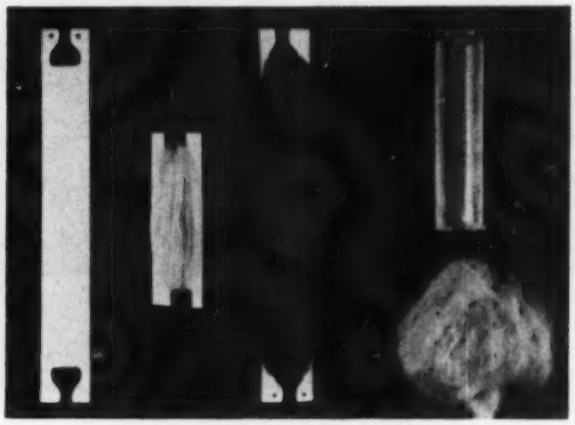


Figure 2
Adaptors for dyeing yarn and rawstock in reflux tubes

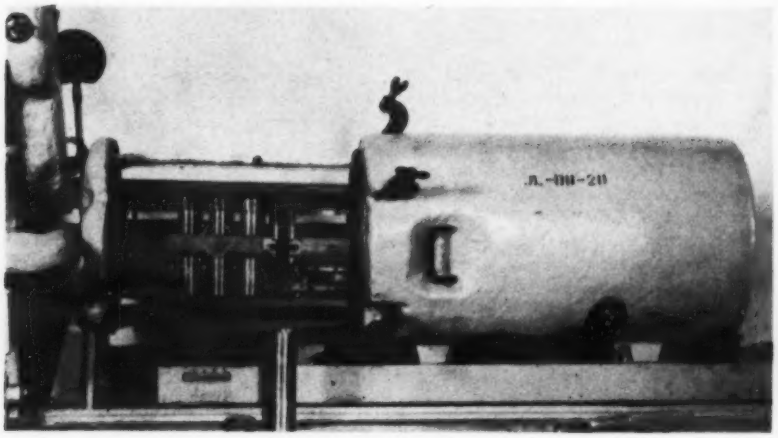


Figure 3
Du Pont pressure-tube dyeing machine

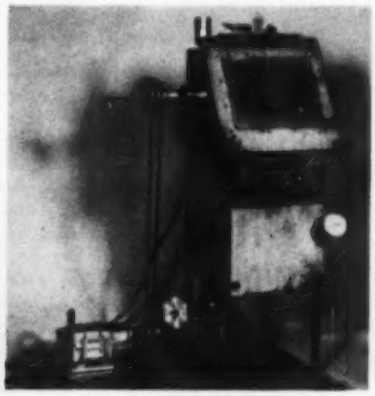


Figure 4
Laboratory beck

paratus, one can scale up to the sample becks found in most dyehouses.

The Du Pont Jackson Laboratory Package Dyer developed by Blaker and Stricklin (*2*) makes it possible to dye 50 to 100 grams of fiber, either yarn or rawstock, with a bath-to-fiber ratio of 10:1 to 20:1. The machine is designed primarily for dyeing under steam pressures up to 50 psi, but it can be operated equally well at atmospheric pressure. A simple lever arrangement permits reversal of liquor flow at any time. These machines are used to make dyeings intermediate in size between the dye tubes and the one-pound machines. These machines are also portable, a battery of several of them permitting rapid shade matching or investigation of variables in process development.

The last laboratory machine to be mentioned is the Barotor pressure-dyeing machine (*3*), which is shown in Figure 5. This is simply a miniature version of the Barotor machine in use in a number of mills today. It is possible to dye piece goods in open width at temperatures up to and above the boil with this unit.

All of this equipment is in use in our laboratories for the investigation of dyeing problems and the development of procedures which are practical for use in mill-scale equipment.

DYEING OF DACRON POLYESTER FIBER

Dacron can be dyed to a full range of shades using disperse dyes. Selected disperse dyes of the Acetamine and Celanthrene types are being used in conjunction with the Latyl dyes, which were developed especially for Dacron. In addition to these, new dyes with attractive application and fastness properties are under development.

REVIEW OF CARRIERS——To dye Dacron with disperse dyes at a commercially feasible rate, it is necessary to operate at temperatures of about 250°F, or at lower temperatures, to employ agents

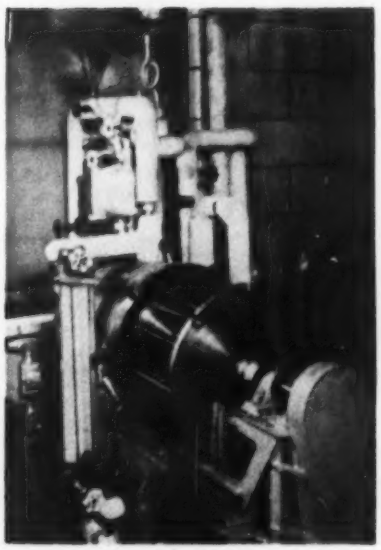
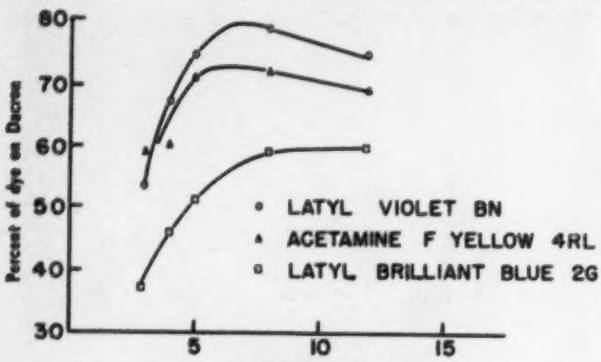
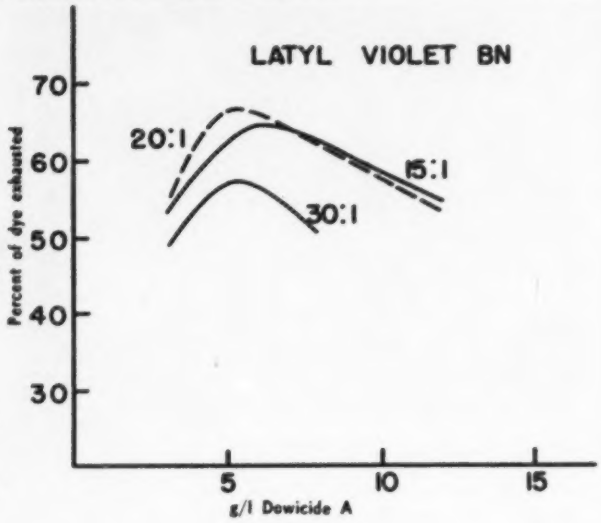


Figure 5
Laboratory Barotor



(Above) Figure 6
Effect of carrier concentration on dye exhaustion onto Dacron



(Right) Figure 7
The effect of bath ratio on carrier concentration for maximum exhaustion on a 50-50 blend of Dacron and wool

or assistants which will increase the dyeing rate. These agents are called carriers. A wide variety of aromatic compounds are used as carriers (4). Some of these are: benzoic acid, salicylic acid, o- and p-phenylphenol, phenol, cresol, biphenyl, acetophenone, phenylmethylcarbinol, mono- and polychlorinated benzenes, and benzoate esters. Many of these are available as proprietary products, in which form they are generally combined with dispersing or emulsifying agents. The selection of the best carrier for any particular job is dependent upon many factors, such as the form of the fiber, the equipment to be used, or the other fibers which may be present in a blend. As an aid or basis for evaluating carriers, it is helpful to list some of the requirements that an "ideal" carrier would possess (5). The "ideal" carrier should be: 1) highly effective, 2) inexpensive, 3) nontoxic, 4) high melting, 5) nonvolatile, and 6) easily removed from the dyeing.

The last three requirements may require a brief explanation. It is desirable to use agents which melt above 212°F; this eliminates the need for good emulsification and also reduces the danger of carrier spotting. If the carrier is a liquid, low volatility is desirable because liquid carriers with even moderate volatility can collect on the cooler parts of the dyeing machine and drip back into the bath as an unemulsified oil which will spot the fabric. And finally, these agents should be easily removable from the finished dyeing, or if not removable, they should not have any deleterious effects.

While none of the compounds listed above fulfills all the requirements of an ideal carrier, dyeing procedures have been developed which give excellent results (5, 6, 7) with many of these carriers. Probably the most widely used carrier is o-phenylphenol, which is discussed more thoroughly in the following paragraphs.

OPTIMUM O-PHENYLPHENOL CONCENTRATION ——— There has been some confusion in the trade about the optimum concentration of o-phenylphenol in the dyebath. The following experiments show that the amount of o-phenylphenol that will give maximum exhaustion is difficult to establish accurately.

A navy shade was dyed on 100% Dacron — polyester-fiber fabric in a laboratory beck using the following dyes:

5.0% Latyl Violet BN
1.5% Latyl Brilliant Blue 2G
0.25% Acetamine Fast Yellow 4RL

A number of concentrations of Dowicide A (tetrahydrate of the sodium salt of o-phenylphenol) were used at several bath ratios. The dyes were extracted from the fabric with monochlorobenzene and the concentration of each of the dyes present on the fabric determined spectrophotometrically.

The results obtained with a 20:1 bath ratio are shown in Figure 6, where the percentage of dye on the fabric is plotted against the concentration of Dowicide A in the dyebath. The amount of each of the dyes on the fabric passes through a maximum as the concentration of the Dowicide A is increased. From this curve, the maximum build-up of dye should be realized at a Dowicide A concentration of about 7 g/l. At 15:1 or 30:1 bath ratio, essentially the same results were obtained. At longer bath ratios, a lower concentration of Dowicide A could be used as indicated by J J Iannarone, O S Larson, and R J Thomas (8).

In the case of blends of Dacron polyester fiber and wool, there was a greater dependence of the optimum concentration of Dowicide A on the bath ratio. This is shown by the curves (Figure 7) for the exhaustion of Latyl Violet BN in the dyeing of Dacron-wool fabric at 15:1, 20:1, and 30:1 bath ratios. It can be seen that the concentration of Dowicide A for best exhaustion decreases as the length of the bath increases. This is also true for the other dyes as shown in Table I.

TABLE I
CONCENTRATION OF DOWICIDE A FOR BEST DYE EXHAUSTION ON 50/50 BLENDS OF DACRON AND WOOL

	15:1	20:1	30:1
	g/l	g/l	g/l
Latyl Brilliant Blue 2G	7	6	5
Latyl Violet BN	6-7	5	5
Acetamine Fast Yellow 4RL	5	5	4-5

Since these dyes are examples of the extremes in dyeing properties, most of the other dyes for Dacron polyester fiber would be expected to fall in this range. Even within this range, however, the differences in exhaustion of the individual dyes with changing Dowicide A concentration is great enough that, in mixed shade dyeings, a shift in the shade will be apparent. Similarly, changes in the bath ratio, such as may be encountered in scaling up from a sample run in which a very long bath is used to a full-scale run with a shorter bath, will necessitate some alteration of the formula. Thus, in defining a shade, it is necessary not only to specify the concentration of the Dowicide A to be used, but also the bath ratio.

In general, in dyeing blends of Dacron and wool, optimum exhaustion is obtained if the following amounts of Dowicide A are used:

6 -7 g/l at 15:1
5 -6 g/l at 20:1
4.5-5.5 g/l at 30:1

While it is obvious that too much carrier can be used, there is more danger of using too little rather than too much, because, as the dyeing progresses, the concentration of carrier in the dyebath is continually being reduced through dilution by the steam condensate and by steam distillation of the o-phenylphenol from the bath. These and other factors upon which the optimum carrier concentration depends will vary from one mill to another to such an extent that the above recommendations really apply to the lower limits, which can be expected to give maximum exhaustion. In addition, these recommendations are for deep shades; smaller amounts of carrier can be used for lighter shades.

REMOVAL OF O-PHENYLPHENOL ——— It is desirable to remove the o-phenylphenol from the dyeings because of its deleterious effects on the light fastness of many of the dyes. In addition, the o-phenylphenol in the fiber discolors on exposure to light so that many dyes with excellent light fastness appear to fade because of the carrier discoloration.

It is not feasible commercially to remove the o-phenylphenol by aqueous scours because a scour at the boil will remove only 30-40% of the carrier. A caustic soda scour at the boil will remove up to 60%, but in most cases this still leaves sufficient carrier to reduce the light fastness of the dyeing.

It is possible to remove the o-phenylphenol by sublimation (6). This is accomplished by subjecting the dyeing to a heat treatment. A temperature of at least 300°F and preferably higher should be used. The heat-treating conditions currently being recommended to aid in pilling control will aid in removing this carrier very well. The fabric is treated at 380°F for one minute. The examples shown in Table II are typical of the increase in light fastness which can be realized when dyeings made with Dowicide A are subjected to this heat treatment.

The conditions used to cure resins are, in general, also useful in effecting this sublimation. In fact, dyed blends of Dacron polyester fiber and rayon which have been resin treated frequently show improved light fastness because of the heat treatment used to cure the resin.

DEVELOPED BLACK ——— A new developed black for Dacron polyester fiber, namely Latyl Diazo Black B, which is now available, permits the simultaneous application of the base and the developer to the fiber. Use of Latyl Diazo Black B with Naphthanil AS-D (9) has resulted in as much as 40% savings in time over

TABLE II

COMPARISON OF LIGHT FASTNESS OF DYEINGS MADE WITH AND WITHOUT DOWICIDE A

Dye	No Treatment (hrs)	Heated 1 Min @ 380°F (hrs)
2% Latyl Brilliant Blue 2G	10-20*	80-160**
2% Latyl Orange R	10-20*	80-160**
2% Celanthrene Cerise B	10-20*	20-40 **

* Fade is dull off-tone shade.
** Monotone fade.

that required for the application of Acetamine Diazo Black RB Conc 150% and Acetamine Developer AD Extra since, in the latter case, it is necessary to apply the base and the developer from separate baths, each followed by a scour. The detailed procedure for a dyeing at 250°F with Latyl Diazo Black B is as follows:

Wet out stock at 160°F.
Paste
2.5% Du Pont Naphthanil AS-D with alcohol and dilute with 190°F water and dissolve with solution containing
0.625% caustic soda.
Add this solution to the machine along with
5.0% Compound No. 8-S dispersing agent and
0.5% Duponol RA surface-active agent.
Adjust bath pH to 6.0 with acetic acid.
Add
5.0% Latyl Diazo Black B dispersed with
2.0% Compound No. 8-S.
Heat to 250°F.
Give running rinse at 180°F for 10 minutes.
Scour for 15 min at 180°F with 2.0% caustic soda,
2.0% sodium hydrosulfite, and 2.0% Product BCO textile-processing agent.
Rinse until neutral.
Diazotize by starting cold and heating slowly to 190°F with
4.0% sodium nitrite and
8.0% sulfuric acid.
Hold at 190°F for 30 minutes.
Rinse until neutral and finish in the usual way.

The fastness properties of the finished dyeings are good. For the very best fastness to crocking, a scour after the diazotization-development step can be given.

The possible use of this dye in dyeing with the aid of a carrier at the boil is being investigated; initial experiments have given promising results.

DYEING OF NYLON

Although nylon is the oldest of the truly synthetic fibers, new uses often require changes in existing dyeing methods. While the disperse dyes produce the most satisfactory dyeings with respect to levelness, they are generally inferior in washing fastness to the dyeings obtainable with acid dyes. Both of these classes produce dyeings which are inferior in both light- and wash fastness to those made with the Capracyl dyes.

IMPROVED LEVELNESS ON SPUN NYLON WITH CAPRACYL DYES ——— Difficulties have been encountered in obtaining levelness on piece goods and carpeting made from spun nylon; however, Capracyl Leveling Salt, a leveling agent which was introduced over a year ago to aid in leveling these dyes on wool, is also useful on spun nylon. The effectiveness of this agent has been demonstrated in the laboratory and recently in a mill trial on nylon carpeting. Excellent levelness and penetration were obtained and the fastness properties were outstanding.

The procedure which is equally good for either rubber coated or uncoated carpeting is as follows:

Pretreat at 212°F for 5 min with
3.0% Capracyl Leveling Salt
2.0% ammonium hydroxide (gives pH of 8.5-9.0).
Add the Capracyl dyes at the boil.
Dye 1-1.5 hrs at 212°F.
Drop bath and finish in the usual manner.

In the first step it may be desirable to use a small amount of ammonium acetate to increase exhaustion with specific shades. The Capracyl Leveling Salt apparently effects the leveling through increase in transfer of the dyes. In the absence of Capracyl Leveling Salt, that transfer which does occur results in unlevel and poorly penetrated dyeings.

IMPROVED LEVELNESS ON FILAMENT NYLON WITH ACID DYES ——— While the process just described is effective on spun nylon, it is not generally useful in overcoming the barré or warp streaks on filament-nylon fabrics. The recent demand for dyed-filament-nylon bed sheeting, either as tricot or flat-woven goods, requires the use of dyes which are fast to household machine washing. The level-dyeing disperse dyes possess insufficient wash fastness for this application. Acid dyes, which have the required washing fastness tend to produce on these fabrics barré or warp streaks, which are caused by both physical and chemical nonuniformities in the yarns. If these nonuniformities are strictly chemical in nature, they can be largely overcome by the dyeing procedure to be discussed below, but if they are physical in nature, such as those resulting from tension difference during draw-spinning, knitting, or weaving, they are more difficult to overcome.

A successful procedure in dyeing dull-nylon-filament tricot bed sheeting consists of pretreating the fabric with Duponol D Paste surface-active agent and acetic acid at the boil, and then dyeing with selected

acid dyes in the presence of Duponol D Paste surface-active agent.

The barré is overcome simply by the occupation of the most readily available dye sites by Duponol D Paste surface-active agent, which for all practical purposes is acting as a colorless acid dye. The true dyes then are distributed more levelly. Since the number of dye sites is reduced, the depth of shade obtainable is also reduced. Thus this method can only be used for light and medium shades.

These same types of fabrics can be dyed at elevated temperatures in the Barotor or Burlington Hy-Press Machine. The increase in temperature aids in leveling; therefore the pretreatment with Duponol D Paste and acetic acid can be omitted. The dyeing is made, however, with 2.0% Duponol D Paste and 2.0% acetic acid in the dyebath. The increased temperature transfers the dyes, and the Duponol D Paste helps this transfer to occur levelly. With procedures of this sort, level dyeings with good wash fastness are being obtained on filament-nylon fabrics, which in the past could be dyed satisfactorily only with disperse dyes. Dyeings made at 235°F or 250°F by this procedure show only a very small decrease in color value; therefore, very full shades are possible.

But a word of caution is in order. Any particular fabric must be dyed in the laboratory first, and if the new procedure shows no improvement, other means of overcoming the barré must be sought. Some fabrics do not dye levelly even with disperse dyes.

SUMMARY

A number of dyeing machines are particularly useful in developing methods for dyeing synthetic fibers. These include: reflux tubes, laboratory becks, Du Pont Jackson Laboratory package-dyeing machine, Du Pont pressure-tube dyeing machine, and the laboratory-size Barotor.

For dyeing deep shades on Dacron polyester fiber, a carrier (Dowicide A) concentration of about 7 g/l is recommended at bath ratios of 15:1 to 30:1. The concentration of carrier in dyeing blends of Dacron and wool appears to be more dependent upon bath length and for this reason 6-7 g/l is suggested at 15:1, and about 5 g/l at 30:1 bath ratio. Heat treatments which sublime o-phenylphenol from Dacron are very efficient in removing residual carrier from finished dyeings and their use results in improved light fastness. By using Latyl Diazo Black B, a new developed dye for Dacron, it is possible to reduce the time required to dye a black shade on this fiber.

In the dyeing of spun nylon, as in the dyeing of wool with Capracyl dyes, Capracyl Leveling Salt is a very effective leveling agent. This is particularly true on spun-nylon carpeting. In the dyeing of filament-nylon fibers with selected acid dyes, the use of Duponol D Paste surface-active agent makes it possible to obtain dyeings either at the boil or at higher temperatures with a minimum of barré.

ACKNOWLEDGMENTS

The results reported in this paper were obtained through a co-operative effort of the Organic Chemicals Department and the Textile Fibers Department of the Du Pont Company. Many individuals have contributed, particularly R A Pearson, J E Reith, and J A Brooks.

REFERENCES

(1) Philadelphia Section, AATCC, *Am Dyestuff Reptr* 38, P9 (1949).
(2) Blaker, R H and Stricklin, T W, *ibid* 43, 392 (1954).
(3) Cole, P M, *ibid* 42, P32 (1953).
(4) Anon, *Tech Bull (Du Pont)* 8, 69 (1952).
(5) Landerl, H P, and Remington, W R, Z *ges Textil-Ind* 57, 598 (1955).
(6) Laucius, J F, *Am Dyestuff Reptr* 42, P792 (1953).
(7) Laucius, J F, and Meunier, P L, International Conference of Man Made Fibers, June 1, 1954, Paris.
(8) Iannarone, J J, Larson, O S, and Thomas, R J, *Am Dyestuff Reptr* 43, P610 (1954).
(9) Iannarone, J J. Unpublished Data.

AATCC Monograph No. 2

"THE APPLICATION OF VAT DYES"

"The group of fifteen editors responsible for this monograph consists of a well-balanced cross-section of American industry concerned with the production, marketing and application of vat dyes. The AATCC is to be congratulated on the production of a comprehensive survey of American vat dyeing and printing practice which is the major theme of this application . . . the book will be useful as a work of reference at this side of the Atlantic and as a working manual for the American colorists for whom it was designed. . . . If a clear account of American practice is required . . . the enquirer must have access to this volume."—*JOURNAL OF THE TEXTILE INSTITUTE* (England).

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". . . this monograph should be in the hands of every user of vat dyestuffs, every student and every teacher. The book is well indexed and includes valuable lists of equivalent trade names. It will certainly take its place as a standard book of reference."—*JOURNAL OF THE SOCIETY OF DYERS AND COLOURISTS* (England).

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South Central Section Outing • July 29-30, 1955 • Lookout Mountain Hotel Chattanooga, Tenn

(See report on page P654)

(Courtesy of Andrew J Kelly, Burkart-Schier Chemical Co)

A—Lookout Mountain Hotel, Chattanooga, Tenn, site of the South Central Section's 1955 Outing

B—South Central Section Officers for 1955-56———(L to r): Frank Cater, Ray-Sar Dyeing Co, treasurer; J C Whitt, Standard-Coosa-Thatcher Co, vice chairman; W F Luther, Dixie Mercerizing Co, chairman; E V Helms, Geigy Dyestuffs, secretary; J T Bohannon, American Aniline Products, Inc, retiring chairman

C—Daniel S Rion, Nopco Chemical Co, winner of the low gross (suppliers) golf trophy

D—(L to r): Mr and Mrs Joe T Bohannon; Mr and Mrs Lowell Shive; Dr and Mrs W F Luther. Mr Shive, Arnold Hoffman & Co, Inc, served as outing chairman

E—Ladies' bridge and canasta

F—(L to r): Mr and Mrs J C Whitt; Mr and Mrs William G Agnew (Dixie Mercerizing Co)

G—Evening banquet

H—(L to r): Jack Z McNab, Mac Chemical Co; Harvey DeLay, Standard-Coosa-Thatcher Co; Norman L Price, Rockwood Mills

I—Horseshoe Pitching: (L to r): William B Griffin, Dexter Chemical Corp; unidentified; W F Luther; Ralph A Madaris, G H Rauschenberg Co, Inc

J—Casting: Homer Whelchel, Central Franklin Process Co (left) and Gordon E Wallace, Arkansas Co

K—Down the middle

L—"Try my nonslicing driver!"

Rhode Island Section Outing
June 10, 1955
Pawtucket Golf Club, Pawtucket, R I

(Report on page P483, July 18th issue)

(Photos by Kenneth C Everett)

coloid Golden Orange, *CI* 1098) with improved results.

Thus the action of the cobalt compound appears to be effective for the overreduction of sensitive dyes as well as for use with the heat-sensitive dyes of the Pyranthrone class. The presence of the element cobalt, which may also be introduced in another way, eg, by adding higher cobalt oxides to the dyestuff wet-filter-cake, or other cobalt salts, such as acetate, linoleate, resinate, etc, is said to be responsible for the alleged improvement in vat dyeing at elevated temperatures.

References cited by the Patent Office:

Brit Pat 534,085 [Imp Chem Ind (1941)]: dyeing nylon with anthraquinoid vat dyestuffs at temperatures between 85-100°C (preferably between 85-95°C) using as a reducing agent sulfoxylate formaldehyde or formaldehyde bisulfite instead of the customary sodium hydrosulfite.

USPat 2,067,927-8 [Nat Aniline & Chem Co (1937)]: using sodium sulfates of lower alcohols (up to 5C), such as isobutyl sodium sulfate, as assistants in printing vats; the paste contains optionally Ni-, Mn- or other heavy metal salts. The alkylsulfate may also be replaced by sulfates of glycols or glycerine.

SHRINKPROOFING, ALSO CREASEPROOFING, WITH MELAMINE CONDENSATES Modified with Aminosulfuric Acids A,2,04

US Pat 2,688,607 (Am Cyanamid——T J Suen ——Sept 7, 1954)

Melamine is condensed with an aqueous formaldehyde solution under moderately acid to neutral conditions; individual examples call for pH values between 3.9-7.2 (example #5). After a short reaction period at elevated temperature, the mixture is cooled down and an aminosulfuric acid, eg aminoethylsulfuric acid, preferably in neutralized state, is added (col 5, line 50). The pH of the resin solution so modified may be within 4-11, but preferably between 6 and 8. It is also possible to react the three components together, but condensing the melamine and formaldehyde first and thereafter adding the aminosulfuric acid is preferred.

After preparing this precondensate, it is desirable to add a curing accelerator, such as ammonium chloride, triethanolamine hydrochloride, etc. A table refers to the application of various accelerators, giving their respective shrink- or creaseproofing effects.

Examples:

A 37% solution of aqueous formaldehyde was adjusted to a pH of 3.9, melamine was added and the mixture heated for 25 minutes to 80-85°C. It was then cooled down to 50°C. 2-amino-ethyl sulfuric acid and a 10% NaOH solution were added at a pH of about 10.9; the condensation was continued at 60-65°C. A completely water-miscible product resulted.

According to example #11 this condensate was diluted to a 10% concentration on resin, after which ammonium chloride was added as an accelerator. Wool flannel impregnated with this solution, squeezed to a pick-up of 100% and cured at 290°F for nine minutes showed a shrinkage of only 4.4% after 5 washing cycles, while the nontreated control sample shrunk about 15% under the same conditions.

Modification of the melamine-formaldehyde condensate with amino alkylsulfuric acid (salts) apparently has various advantages. The solution is stable at room temperature without precipitation or coagulation. Stiffer or softer finishes may be obtained by adjusting the pH below or above 7 respectively.

No references are cited by the Patent Office.

SHRINKPROOFING WOOL ———Impregnation with N-Alkoxy-Polyamides, Converted to Nylon Substance A,2,04

US Pat 2,689,193 (Commonwealth Scientific & Industrial Research Organization——Lipson, Jackson——Sept 14, 1954)

Nylon-type polyamides substituted on the nitrogen are described in Du Pont's Brit Pats 573,482 and 576,363. These products result when nylon is dissolved in formic acid and reacted with formaldehyde or with paraformaldehyde plus methanol, thus linking CH_2OH— (methylol-) or CH_2OCH_3 — (methoxymethylol-) groups respectively to the N atom. The solubility of the original substance is changed by this substitution; thus, according to Brit Pat 573,482, a reaction product containing 5.77% methylol groups is soluble in 25% concentration in 80% ethanol.

The present invention advocates the use of these nylon derivatives dissolved in 95% ethanol, to which *a small amount of caustic has been added*, for impregnating wool fabric. After the material is squeezed and dried, it is immersed in a solution of mineral or acetic acid, whereby the original nylon substance is regenerated within the fibers. After other ingredients are washed from the fabric it is left shrinkproof.

Example:

An air-dry wool fabric was immersed for 30 minutes at 25°C in a 1.5% concentrated solution of N-substituted nylon in 95% ethanol, mixed with a small amount of potassium hydroxide. (The polyamide, according to analysis, contained 10% of bound formaldehyde of which 9.8% was methoxymethyl and 0.2% hydroxymethyl groups). After being squeezed, partly air dried and immersed in a 7.3% hydrochloric acid solution at 25°C for 30 minutes the nylon substance was regenerated. The fabric thereupon was washed to an acid-free state and dried again, showing a weight increase of 1.3%. In a washing test the area shrinkage was determined as 12% in contrast to that of the nontreated material, where it amounted to 40%. It should be emphasized that the caustic alkali, though present in small amounts only, has a definite influence on the final effect. Tests in which the caustic alcoholic solution is omitted show relatively poor shrink resistance.

References cited by the Patent Office:

USPat 2,395,791 [Cluett Peabody (1946)]: rendering wool shrinkproof with a caustic alcoholic solution. Impregnation is done with a resin dispersion, eg, Aerotex, Beckamine, Rhonite [cf *Am Dyestuff Reptr* 35, 336 (1946)].

USPat 2,443,450 [Du Pont (1948)]: coating with N-substituted polyamides, generally of a high degree of substitution (28%), containing a major percentage of alkoxymethyl groups and a lesser percentage of methylolgroups (below 4%).

Brit Pat 626,581 [Du Pont (1949)]: using N-substituted polyamides of the same type as described in the preceding reference as fixing agents in the pigment printing or dyeing of textiles; fixation is carried out by conversion into insoluble state by heating or acidifying.

PRINTED CALENDER EFFECTS———Resists under Resin Precondensates D,1

US Pat 2,681,867 (Calico Printers' Assoc—— Miller——June 22, 1954)

Durable calendering effects may be produced by first impregnating with a hardenable resin precondensate, then embossing (or glazing, schreinering, etc), and finally, curing the thermosetting resin. This method may be applied well on fabrics which are uniformly padded with the resin solution, dried, calendered

and cured; but irregular results can be expected when resins are applied locally by printing, drying and embossing. In this event it is said to be practically impossible to control the drying temperature in order to prevent premature resin formation which results from overheating. Consequently portions of the resin would also stick to the non-ornamented parts of the fabric.

The inventor proposes the inverse way for obtaining printed plain areas surrounded by ornamented portions, ie, glazed portions, etc. An aqueous salt, which loses most of its solubility upon heating, is used in preprinting of the fabric. The printed fabric is then dried well and subsequently impregnated all over with an acetone-formaldehyde precondensate plus an alkaline (mostly sodium carbonate) catalyst, after which it is carefully dried at low temperature, subjected to mechanical ornamentation, heated so as to cure the resin, and washed to remove soluble residues as well as the mechanically produced but unstable effect from the printed areas. The aqueous salt combines with the alkaline catalyst on the printed areas, thereby preventing local resin formation. Among the suitable salts which act as resists are organic acid (formic or acetic) salts with weakly basic metals, such as Al, Sn, Zn, Cr and so forth, or ammonium salts of sparingly soluble organic acids, such as salicylic, benzoic acids or the like.

It is also possible to add dyes either to the resin solution or to the resist to obtain variegated effects. The metal salts contained in the resist can further serve as mordants for chrome dyes as described in example #5 (Chromazurine E).

Example:

A starch tragacanth thickened paste containing 8.5% of aluminum formate was printed on a cotton fabric; after drying, the fabric was impregnated with a precondensate of formaldehyde and acetone plus sodium carbonate. After being carefully dried at a temperature below 100°C the cloth was passed through a frictioning calender, cured for 4 minutes at 120°C, washed and dried. The result was a plain pattern on a glazed ground.

Among the references cited by the Patent Office:

USPat 2,531,814 [Heberlein Patents Corp (1950)]: discusses combined prints with resists containing pigments and parchmentizing agents. An aftertreatment with a shrinking agent is employed to obtain different pigmented and parchmentized effects beside one another [cf *Am Dyestuff Reptr 40,* 279 (1951)].

USPat 2,454,391 [Cranston Print Works (1948)]: preprinting a polymerizable melamine-formaldehyde paste on a cloth, drying at low temperature, glazing the fabric across the entire width, curing and washing. The printed areas only retain the calendering effect, which is removed from the nonprinted areas by washing. This is apparently parallel to Brit Pat 597,435 (1948) [cf *Am Dyestuff Reptr 38,* 206 (1949)].

USPat 2,159,875 [Cilander A G (1939)]: shrinkproofing and stabilizing fabrics by impregnating with precondensates of acetone and formaldehyde in the presence of an alkaline catalyst.

USPat 2,121,005 [Raduner & Co (1938)]: ornamenting fabrics on a calender by impregnating with a resin precondensate containing an acid catalyst, drying slightly, embossing or glazing and curing.

USPat 2,093,651 [Widmer-Pierce (1933)]: dyeing vegetable fibers with acid dyes fixed by condensates with urea-formaldehyde, guanidine condensates, etc.

STRIPPING WOOL IN THE PRESENCE OF ALKYLENE DIHALIDES———Followed by Acid Stripping C,1

US Pat 2,685,496 (Harris Research Labs——Harris, Brown——Aug 3, 1954)

The stripping of dyed wool waste in the form of shoddy, clippings, rags, etc, before reprocessing is generally carried out in acid media wtih sodium- or zinc sulfoxylate formaldehyde. This treatment chemically and physically affects the fibers, decreasing their resistance in subsequent oxidizing or reducing procedures under alkaline or acid conditions. Moreover, the natural softness of the material is mostly impaired.

The inventors have advocated (see reference to USPat 2,508,715 below) that dyed wool which has to be stripped be subjected to the action of alkylene dihalides combined with a reducing agent. This process has the effect of replacing cystine linkages, which are interrupted by the action of the reducing agent, with stable alkylene linkages.

An improvement over this method is suggested by the current patent. The process described above is referred to in this specification as "the first stage". It is followed by a different stripping action under acidic conditions, termed "the second stage", in which alkylene halide may or may not be present. A pretreatment with oxalic acid solution is optional; it is preferred in stripping chrome-dyed materials.

Example:

10 p chrome-dyed wool are pretreated at the boil for 15 minutes in a bath of 0.5 p oxalic and 0.5 p sulfuric acid in 300 p water. After being neutralized with alkali and borax the solution has to be cooled down to 60°C, and 0.5 p dibromo ethane, 0.025 p red oil and 3 p sodium hydrosulfite added. The wool is treated for 15 minutes at 90°C; thereafter the old bath is removed, the stock rinsed well and about the same volume of hot water, containing 0.2 p zinc sulfoxylateformaldehyde and 15 p 90% formic acid, applied in the "second stage" for 15 minutes. Finally the wool is rinsed. The addition of some sulfuric acid is optional.

Among the references cited by the Patent Office:

USPat 2,508,714 [Harris Research Labs (1950)]: stripping of color from wool or other keratinous fibers by scouring with ammonia, rinsing and aftertreating with a reducing agent at elevated temperatures in the presence of a small amount of an alkylene dihalide [cf *Am Dyestuff Reptr 39,* 726 (1950)]. See also references to this digest.

USPat 1,958,483 [Celanese Corp of America (1934)]: stripping of cellulose acetate fibers dyed with dispersed (acetate) dyes with (zinc) sulfoxylate formaldehyde, a hypochlorite treatment follows.

Some other patent references which mention generally bisulfite-, hydrosulfite- or sulfoxlate-stripping methods are included.

An article in *J Soc Dyers Colourists* (Gaunt, p 429, Sept, 1949) discusses wool dyeing with chrome dyes; it is assumed that fission of the disulfide bonds probably occurs in the hot liquid, thereby reducing the hexavalent to tervalent chrome, the latter being very firmly fixed on the wool fiber.

VAT DYEING BUFFERED AGAINST OVERREDUCTION ———Trialkanolamine or Manganese Compounds Added C,4,02

US Pat 2,683,641 (Am Cyanamid Co——Mecco ——July 13, 1954)

US Pat 2,683,646 (Am Cyanamid Co——Fordemwalt——July 13, 1954)

These two patents have a similar objective, which becomes evident in comparing the preambles.

Numerous vat dyes have shown sensitivity to overreduction at elevated temperatures. Patents assigned to the same Company have advocated various overreduction buffers for avoiding this disadvantage. USPats 2,548,543-4 (1951) [cf *Am Dyestuff Reptr 40,* 538 (1951)]: cover the use of inorganic nitrites and halogenates respectively; USPat 2,576,846 [cf *Am Dyestuff Reptr 41,* 307 (1952)]: protects the claims for the use of organic nitrogen compounds in which N is attached by at least one covalent bond to O and by at least one bond to an element other than N or O (examples, among others: nitropropane or nitrobenzene). Also, dyeing with Pyranthrone dyes, which are not sensitive to overreduction, was found to be substantially improved

using nitrites or halogenates [USPat 2,548,545-6; cf *Am Dyestuff Reptr 40*, 605 (1951)], or by applying the aforementioned organic nitrogen compounds [USPat 2,576,847; cf *Am Dyestuff Reptr 41*, 307 (1952)].

Despite the greatly improved dyeing results achieved using these buffering substances, it has been observed that this effect is obtained at the expense of an *increased hydrosulfite consumption*. The reason for this phenomenon cannot be fully determined, but a chemical reaction of hydrosulfite with the buffer may be assumed.

USPat 2,683,645 suggests the reduction of the excessive hydrosulfite consumption by incorporation of a trialkanolamine (triethanolamine in most of the examples) in an amount of 0.1 to maximum 1.0% based on the alkali hydrosulfite's weight.

Example:

A bath containing 4 oz/gal NaOH, 2 oz/gal sodium chlorate and 0.01 oz/gal triethanolamine was heated to 200°F whereupon 4 oz/gal sodium hydrosulfite was added. The rate of hydrosulfite consumption was found to be only 50% of that determined (by titration with indigo standard solution) in absence of triethanolamine, thus proving that losses of hydrosulfite had substantially decreased in this experiment.

USPat 2,683,646 suggests that a similar effect can be attained by the addition of manganese compounds to the buffered dyebath. The same effect is also evident in buffered hydrosulfite solutions that contain no vat dyes, as used in the pigment-pad-dyeing method for developing the padded-on non reduced dyestuff.

Examples of manganese compounds are: manganous chloride, manganous sulfate, potassium permanganate, etc.

References cited by the Patent Office to USPat 2,683,645:

USPat 1,782,122 [Du Pont (1930)]: improving a vat color paste for further use in dyeing and printing by adding a monoalkanolamine as an auxiliary; the two other reactive H atoms may be replaced by alkanol or alkyl groups.

Brit Pat 324,315 [I G Farben (1930)]: incorporation of organic alkali compounds of alkanolamines into dyestuff preparations, for instance, products obtained by the stirring of dipropanolamine with potassium carbonate.

References cited by the Patent Office to USPat 2,683,646:

USPat 1,584,202 [Bad Anilin- & Sodafabrik (1926)]: formation of sticky deposits in dyestuff preparations can be prevented by the addition of a small amount of permanganate to the paste with precipitation of insoluble manganese compounds, chiefly oxides.

USPat 2,067,927-8 [Nat Aniline (1937)]: salts of acid alkylesters, eg, isobutyl- or n-amyl sulfate of sodium, are used as vat-dyeing or printing assistants, optionally combined with heavy metal salts, such as those of Fe, Ni, Co or Mn, or with the corresponding ester salts of polyalcohols, eg, glycol disulfates.

Back numbers of American Dyestuff Reporter less than two years old may be obtained from Howes Publishing Co, Inc, 44 East 23rd Street, New York 10, N Y, and earlier numbers from the Secretary, American Association of Textile Chemists and Colorists, P O Box 28, Lowell Massachusetts.

Prices postpaid: 50 cents each to nonmembers of AATCC, 35 cents to members; complete volumes $5.25 to nonmembers, $4.50 to members.

GENERAL CALENDAR OF COMING EVENTS

AMERICAN CHEMICAL SOCIETY
128th National Meeting—Sept 11-16, Coffman Memorial Union, Minneapolis, Minn.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS
National Convention—Sept 26-28, Lake Placid, N Y.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
Mid-Atlantic Textile Conference—Nov 3-4, N C State College, Raleigh, N C.

THE FIBER SOCIETY
Spring Meeting—May 2-3, The Clemson House, Clemson, S C.

NATIONAL COTTON COUNCIL OF AMERICA
1955 Chemical Finishing Conference—Sept 20-21, Chalfonte-Haddon Hall, Atlantic City, N J; 7th Annual Cotton Research Clinic—Feb 15-17, Pinehurst, N C.

NATIONAL COUNCIL FOR TEXTILE EDUCATION
October 17-19, The Larches, Hopedale, Mass.

THE NATIONAL FEDERATION OF TEXTILES, INC
Annual Meeting—Oct 4.

NATIONAL SAFETY CONGRESS AND EXPOSITION
Industrial Safety Sessions—Oct 17-21, Conrad Hilton, Morrison and La Salle Hotels.

NORTHERN TEXTILE ASSOCIATION NATIONAL ASSOCIATION OF COTTON MANUFACTURERS
Annual Convention—Sept 29-30, Wentworth-by-the-Sea, Portsmouth, N H.

PHI PSI FRATERNITY
Annual Meeting—April 19-21, Alabama Polytechnic Institute, Auburn, Ala.

THE QUARTERMASTER ASSOCIATION
Annual Convention—Oct 27-28, Conrad Hilton Hotel, Chicago, Ill.

SOCIETY OF INDUSTRIAL PACKAGING AND MATERIALS HANDLING ENGINEERS
Packaging & Handling Exposition—Sept 20-22, Kingsbridge Armory, New York, N Y.

SOUTHERN TEXTILE EXPOSITION
19th Exposition, Oct 1-5, 1956, Textile Hall, Greenville, S C.

SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION
Sept 14, Oct 11, Nov 9 (Hotel Commodore, New York, N Y).

TEXTILE METHODS AND STANDARDS ASSOCIATION
Fall Meeting—Sept 29-30, Clemson House, Clemson, S C.

TEXTILE TECHNICAL FEDERATION OF CANADA
5th Bi-annual Textile Seminar—June 5-7, Queen's Univ, Kingston, Ont.

News of the Trade

• Consumption of Nitrile Latices Upped

Consumption of nitrile latices in the textile, chemical and related fields, is reported to have increased 62.5% during the first half of 1955 as compared to the same period in 1954.

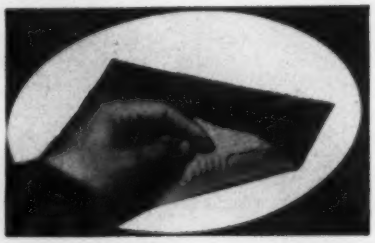
H R Thies, general manager of the Chemical Division of the Goodyear Tire and Rubber Co, recently stated that a total of approximately 6.5 million lbs were consumed during the first six months of this year as against 4.0 million lbs through June of 1954. He attributed the increase principally to the increased demand for nitrile latices in the manufacture of nonwoven fabrics. He also stated that the latices are being used in increasing quantities as carpet backing materials, and in combination with other latex products for new improvements in textiles.

As a result of the economies afforded the automobile manufacturers in this year's models, Mr Thies predicted that nonwoven fabrics will be used as backing materials in virtually all automobile models in 1956. He cited Lantuck as typical of the nonwoven fabrics now being used for which there will be a greater market in the future. Lantuck is supplied by Wallington Sears Co, selling agents for West Point Mfg Co, producer of the material. Goodyear's Chemigum latices are used in the manufacture of Lantuck to bind the individual textile fibers together and consequently give equalized strength to the fabric in all directions. Lantuck is then combined with vinyl sheeting by plastic converters and sold to automobile manufacturers for use in various upholstery applications.

The use of Chemigum latices as carpet backing materials is said to make rugs and carpets more durable, ravel free, and resistant to water and drycleaning solvents. It is also claimed that carpet treated with Chemigum latex has no effect of floor finishes, and that the backing will last throughout the life of the carpet.

Regarding combinations of Goodyear's latex products, Mr Thies stated that new developments in warp sizing and finish sizing of fabrics are contemplated using Chemigum - Pliolite latex combinations. Development testing is said to indicate that adhesion and wash fastness in textile fabrics is considerably enhanced by this combination.

Another combination of latices, Chemigum and Pliovic, reportedly is giving fabrics better abrasion resistance and tensile strength, superior adhesion, and excellent oil, grease and solvent resistance. As a result, Mr Thies remarked, these latices are being used as grease-proof coatings for packaging materials, rug backings, binders for nonwoven fabrics, and similar applications.



Rentention of embossed patterns is said to be enhanced when Lantuck nonwoven fabrics are used as backings for vinyl sheet. As a result, the combination of Lantuck and vinyl are finding increasing usage in upholstery items, such as door panelling, scuff pads, and seat bolsters in several 1955 automobile models. Lantuck adds strength and support to the vinyl sheet in these applications.

FRED C SCHOLLER (right), president of Philadelphia Textile Institute Foundation, is shown presenting a bronze plaque to EDWARD S ATKINSON, on behalf of friends who contributed a purse of $7,500 to dedicate a room in his name in new Residence Hall Building of PTI. The presentation noted Mr Atkinson's 70th birthday and was made at a party given by his friends in Atlantic City on August 26th. Mr Atkinson is a member of the Scholler Bros, Inc, Sales Department.

• Nopco Reveals Huge Market Rise for Foams

The market for urethane foams should rise shortly from a few hundred thousand pounds a year to one hundred million pounds a year, Ralph Wechsler, president of the Nopco Chemical Co, declared last month.

Revealing further details of a huge expansion program into the cellular plastics field, Mr Wechsler announced the appointment of George G Stier as assistant vice president in charge of the Plastics Division, which will open two new plants this year and a third next year. Mr Stier, who has been with Nopco since 1932, has been assistant vice president in charge of the Industrial Marketing Division which included urethane-foam applications.

Mr Wechsler's prediction of a 1,000,000-lb market for urethane foamed Plastics in the next five years is based upon a market analysis by Nopco, which produces both vinyl foams and urethane foams, rigid and flexible.

At present about 400,000 pounds of urethane foams are being produced annually, largely for development purposes. Plans for Nopco's Plastics Division call for completion of two plants this year, one in New Jersey and the other in California, with a capacity of one million pounds of foam and components annually.

The New Jersey plant, which will produce rigid and flexible urethane and vinyl foams, will include the Research Laboratory and the Engineering and Applications Department. Personnel presently engaged in plastics production reportedly will be quadrupled.

• Chemical Purchasing Agents to Plan Program

The Executive Committee of the Chemical and Allied Product Buyers' Group, a Division of the National Association of Purchasing Agents, will meet in St Louis, Mo, on Sept 26th to discuss plans for the regional mid-winter meetings to be held in Chicago and New York in January and for the annual NAPA Convention in Cleveland next May.

While in St Louis, the Committee will be the guests of the Monsanto Chemical Co at a plant tour and luncheon on Sept 27th. J R Sayers, manager of planning and research, Central Purchasing Dept, will act as host.

• New Organizational Structure at Wyandotte Chemicals Corp

Wyandotte Chemicals Corporation, Wyandotte, Mich, has announced the formation of three newly constituted divisions, effective September 1. The new Michigan Alkali Division will be made up of the present Michigan Alkali Sales and Manufacturing Divisions . . . the Research and Engineering Division will encompass present research activities, engineering, production-research and new business-development departments . . . and the General Products Division includes purchasing, traffic and nonchemical sales and manufacturing operations.

Concurrently, the board of directors elected Bert Cremers vice president and general manager of the new Michigan Alkali Division. In his new post, Mr Cremers will be in charge of the divisional sales activities, as well as the manufacture of all Wyandotte's chemical products, including soda ash, bicarbonate of soda, chlorine, caustic soda, glycols and related products, synthetic detergents, etc.

In 1942, Mr Cremers was elected to the vice presidency of the sales division simultaneously with the consolidation of the Michigan Alkali Co and J B Ford Co to form Wyandotte Chemicals Corp.

Cremers

Newly elected vice president Frank Wolcott will head the Research and Engineering Division, which has been established to consolidate technical activities and put greater emphasis on development and marketing of new products. Previously, Mr Wolcott was vice president and general manager of manufacturing for the company.

The General Products Division will be headed by its newly elected vice president and general manager, George W Schwarz. This new division's activities includes operation of the company's quarry at Alpena, Mich, as well as the Wyandotte Transportation Co; also the sale of coke, foundry products, and other nonchemical products and services. Mr Schwarz has been with the company 12 years as controller, treasurer and vice president.

The manufacture and sale of industrial and specialized cleaning compounds will continue under the J B Ford Division, directed by Ford Ballantyne Jr, vice president and general manager.

• "Certified Washable Week" Plans Set by AIL

The "Certified Washable" Seal program of the American Institute of Laundering will receive a concentrated promotional impetus, according to plans now underway for the first Institute-sponsored "Certified Washable Week", October 13-20, 1955.

The AIL "Certified Washable" Seal, which is also the seal that identifies Institute members, will receive national attention as manufacturers that have earned the Seal, retail stores and the AIL itself combine in promotion of the Week.

Albert Johnson, general manager of AIL, declared that the Week will emphasize the public service contribution of the laundry industry in helping consumers determine what products being promoted as launderable are truly washable.

Ward Gill, director of the AIL Seal program, said that complete promotional kits tied to the national advertising program will be made available to laundries.

NEW PRODUCTS AND DEVELOPMENTS

• Hold New Electric Guider Switch Will Not Burn Out

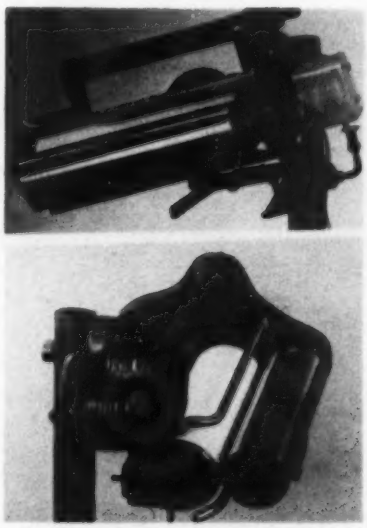
A major problem of electric guider operation, that of switch burnout, is frequently due to the high inductance of the magnetic coils and the number of operations — often 400 a minute or 576,000 every 24 hours.

As an answer to the problem, the Guider, Roll and Service Co, P O Box 3747, Peninsula Sta, Daytona Beach, Fla, has developed electric guiders that incorporate a method which reportedly dissipates the flash or hot arc causing the switch contacts to burn.

According to the Company, the switches will eventually wear out but never burn out the contacts. Provision has also been made for a quick replacement of the switch. A new switch can be plugged in instantly. However, it is claimed that switches will not require replacing more often than twice a year at a cost of $2.00 each.

Another feature of the new guiders, known as the Hetherington Super Electrics, is an arrangement by which the position of the rubber cradle roll can be adjusted in relation to the front or stationary roll. The rolls are brought close together for guiding fine fabrics and further apart for heavier goods. According to the Company, this gives extremely accurate guiding and eliminates practically all of the side-to-side motion of the cloth. The knurled wheel at the back of the coils allows this roll adjustment to be made instantly.

The Company states that all types of air guiders can be easily converted to electric operation with its new switch and adjusting wheel.



Top illustration shows the new switch box with arc quencher. Bottom shows position of coils and knurled wheel for adjusting the position of the cradle roll for fine or heavy cloth.

• D & F Chemical Adds to Line

D & F Chemical Co, 2004 South Marshall Blvd, Chicago 23, Ill, has added several new inorganic compounds to its line. They are being produced on a larger-than-laboratory scale.

Representative of the compounds are the following: hexaminecobalt(III) bromide, hydroxylammonium arsenate, potassium trioxalatoalumninate, tris(ethylenediamine)-chromium(III) bromide, barium bromate, calcium dithionate, cobalt cyanide, zirconium disilicide, silver chlorate, and arsenic hydride.

• Morton PCB Salt

After years of research and testing for the most economical means of producing a purer rock salt brine, Morton Salt Co, Chicago, Ill, has introduced Morton PCB Salt, a low calcium brine for the textile industry.

Now available for the first time, Morton PCB Salt is essentially a screening of Southern rock salt to which has been added a combination of chemical ingredients to effectively prevent harmful calcium compounds from going into solutions. The new product is said to be advantageous wherever a low calcium, low cost brine is desired.

This method of making brine is patented under U S Pat 2,433,601 (other patents pending) and may be used with standard rock-salt-dissolving equipment.

The manufacturer points out that the product can be used to advantage wherever a low-calcium, low-cost brine is desired. More specifically, they recommend it when brine is used in dyeing (rawstock, package, beam, beck or jig) with either sulfur, direct or naphthol dyes. Morton PCB brine can also be used effectively for zeolite water softening, it is reported.

PCB rock salt brine is said to average less than 200 ppm calcium (and it is claimed that even this will not precipitate), thereby offering advantages in low calcium content, aid in retarding corrosion, low cost, reduction in the amount of sequestering agents required, simplicity of purifying, and nonsusceptibility to mechanical failure.

Morton PCB Rock Salt is available in 100-lb bags or bulk.

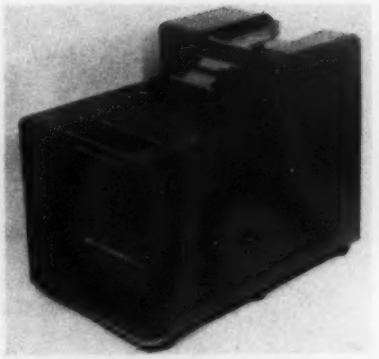
Further information may be obtained from the Company's Industrial Division, 120 LaSalle St, Chicago 3, Ill.

• New Fablok Dye Nets

A new knitted net, the "Elite," for bleaching and dyeing Orlon and Acrilan seater fabrics and skeins, and for dyeing hosiery, has been introduced by Fablok Mills, Inc, Irvington, N J. The net offers the small square openings preferred by some sections of the trade, but its knitted construction is said to have the nonrun, nonravel, nonskid features characteristic of knitted nets with larger mesh openings.

The new net is offered in nylon, type-81 Orlon, and Dacron, in all sizes including a special 7" x 36" size for skein dyeing.

According to Jack Rachleff, sales manager of Fablok Mills, the Dacron nets are proving particularly effective in resisting the strong bleaches used in obtaining bright whites, and in rejecting the darker basic dyes now becoming popular.



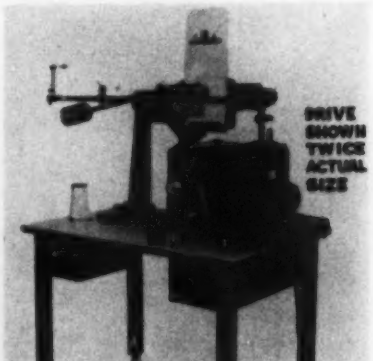
Shown above is the Nep Machine designed by the U S Dept of Agriculture and now being offered by Custom Scientific Instruments, Inc, of Kearny, N J (see page 642 of August 29th issue). The unit is written up in the USDA Bulletin of Nov, 1954, under the title "Laboratory Equipment and Method for Making Nep Tests on Cotton Samples."

• Instant-Return Drive Added to Scott Incline-Plane Serigraph*

To facilitate use for breaking-strength test, Scott Testers, Inc have added an instant-return feature to their Incline-Plane Serigraph*, which is a standard instrument for hysteresis tests from 4 to 16 grams for single fiber and from 0 to 2000 grams for yarn. Constant-rate-of-load is applied by means of a rolling weight which loads the specimen as the plane is inclined from the horizontal. The drive, which inclines the plane at the predetermined rate, is reversible at the same rate for hysteresis tests. The addition of the instant-return feature is said to permit instant return to starting position from any point of the test cycle by touching a lever on the gear box. This feature reportedly gives the machine much faster operation in production testing for ultimate tensile, as well as making it more flexible in any type of test.

The new gear box, which retains all the features of the original plus the instant-return improvement, can be applied to existing Scott IP-2 Serigraph either at the factory, at Scott Testers, Inc, 63 Blackstone Street, Providence, R I, or at the Southern service facility, Scott Testers (Southern), Inc, P O Box 834, Spartanburg, S C.

*Registered Trademarks.



Scott Testers' Incline-Plane Serigraph with new Instant-Return drive.

• Mollisan

Mollison, an unusual new nonionic textile lubricant that is reported to be extremely versatile in its applications, has been developed by Onyx Oil & Chemical Co, Warren and Morris Sts, Jersey City 5, N J.

Completed tests in both laboratory and mill are said to have demonstrated the functional versatility of the new product as a lubricant, antistatic agent, softener and hand modifier.

Mollisan is said to exhibit extraordinary efficiency in overcoming embrittlement due to resin finishing, and to be advantageous regarding tear strength, abrasion resistance and sewability on resin-finished cottons, rayons, acetates and blends. Its resistance to yellowing, even at temperatures of 450°F in heat-setting operations, is claimed to be outstanding for application to synthetics. The addition of Mollisan in resin finishes is said to significantly upgrade the appearance of the finished fabric.

Onyx points out the effectiveness of Mollisan as an antistatic agent on most synthetic fibers, where it also is said to offer advantages as a yarn lubricant. The product reportedly has demonstrated great versatility in imparting the desired hand to fabrics, ranging from full to soft, depending upon conditions of application.

• 1,5 Pentanediol Commercially Available

1,5 Pentanediol, another in the series of acrolein derivatives, is now available in tank car, tank truck, and drum car load quantities from Carbide and Carbon Chemicals Company, a Division of Union Carbide and Carbon Corporation.

This new diol reportedly undergoes reactions typical of glycols — oxidation, dehydration, esterification and acetalization. It is said to form esters and polyesters that are important intermediates in the manufacture of polyester resins, urethane foams and elastomers, fibrous glass-reinforcing resins and other resinous materials.

Various esters of 1,5 pentanediol have been suggested as plasticizers for such textile fibers as cotton, rayon, and wool, as well as for vinyl polymers.

• Sandopan DTC

A completely new surfactant for cotton, wool and synthetics processing, which is said to combine the advantages of anionic soap and nonionic detergents while inheriting none of their disadvantages, has been announced by Sandoz Chemical Works, Inc.

The new surfactant, called Sandopan DTC, is said to be chemically different from any soap, detergent or wetting agent on the market. It is reported to have remarkable wetting and detergent properties. According to J W Luthy, promotion and application director of the Sandoz chemical department, "Sandopan DTC means faster desizing because of its rapid wetting and penetration properties plus its detergent action in subsequent washings."

Dr Luthy also cited additional instances where Sandopan DTC can be used to advantage in mill operations:

"In kier boiling, Sandopan DTC means 1) faster wetting; 2) uniform distribution of caustic soda; 3) rapid hydrolysis of wax, protein and pectin; 4) no redeposition of impurities when kier is drained or in rope washer after J-box; 5) whiter goods; and 6) outstanding absorbency."

"Sandopan DTC saves bleaching material and at the same time gives a faster, more uniform bleach.

"Scouring synthetics with Sandopan DTC has proved excellent for removal of oil and graphite from tricot, circular knit goods and Helanca yarn fabrics.

"Crease and abrasion resistance of resin finished goods is raised with Sandopan DTC."

It is understood this new Sandoz product will be competitively priced.

• Fabricolor Photographic Prints

In an effort to meet the need in the textile industry for quick, inexpensive color prints, Authenticolor, Inc, 270 Park Ave, New York, N Y, has developed a new process — Fabricolor photographic prints.

The new development is said to make it possible for textile houses to maintain the exact textile colors for salesmen's samples or display pieces at prices, in most cases, less than printing.

The Fabricolor print method is purely photographic, employing a completely continuous tone process.

NAMES IN THE NEWS

SOLOMON EPSTEIN, executive vice president of Emulsol Chemical Corp, Div of Witco Chemical Co, has been assigned the duties of general manager of the Company.

CHARLES FUCHS, formerly chief chemist of Emulsol Chemical Corp, has been elected to the position of vice president in charge of research and development.

VERNER ALEXANDERSON has been appointed development manager for chemical intermediates in the Technical Department of American Cyanamid Company's Organic Chemicals Division. For the past year, he has been staff assistant to the technical director for chemical intermediates and rubber chemicals.

R E ROGERS, manager of the Los Angeles branch of The Foxboro Co since 1946, has been appointed manager of the instrument company's West Coast sales activities. He plans to make his new headquarters at Foxboro's newly completed branch factory in San Leandro, Calif.

Replacing Mr Rogers as Los Angeles branch manager is E W PITT, who has transferred from the Shreveport, La, office where he has been branch manager since 1948. D P THOMAS, industrial engineer, has been promoted to branch manager at Shreveport.

In other new appointments, M F PARR has been made regional engineer at San Leandro; C E HEEGARD has been added as industrial engineer at Los Angeles; and C J DeVILBISS has transferred from Dallas to serve as industrial engineer at Shreveport.

W S McNAB, senior partner of Mac Chemical Co, and Mrs McNab will leave Sept 15th for a tour of South America, including stops at Rio de Janeiro, Sao Paulo and Lima.

HERBERT R MAUERSBERGER has resigned from the faculty at Fairleigh Dickinson College and, for reasons of health, plans to live in Florida.

DORRANCE H GOODWIN has assumed the principal administrative responsibilities of the Lowell Technological Institute Research Foundation following the resignation of JOHN H SKINKLE.

Harrelson

Young

Alpert

HAROLD HARRELSON has been appointed a textile sales technician in the South for Stein Hall & Co, Inc. He will make his headquarters at the firm's Charlotte, N C Branch.

Prior to his new appointment, Mr Harrelson had been superintendent of the Haynsworth Plant (Woodside Mills), Greenville, S C, where he was responsible for operation of the plant since 1954.

Ultra Chemical Works, Inc, Paterson, N J, has announced the appointment of RICHARD M YOUNG, JR to the position of assistant sales manager. In his new post Mr Young will be responsible for the sales activities of Ultra's field representatives.

Mr Young joined Ultra in 1952 as a sales representative for the New York metropolitan area.

MEL ALPERT has been appointed technical service representative for North American Rayon Corp and American Bemberg. He will make his headquarters in the New York sales office of the company at 261 Fifth Ave. Previously he was assigned to the research and development section.

In addition to his new duties, he will continue to represent the North American Rayon Corp on the Rayon and Acetate Producers Advisory Committee.

MARTIN G GALE has been named director of technical service for the Monomer Department of The Borden Company's Chemical Division.

Mr Gale will head the Borden Chemical Division's technical service laboratory in Leominster, Mass.

Distribution of Phosphorus

(concluded from page 647)

Another type of phosphorus-containing flame-resistant fabric (phosphorylated cotton) was also charred under the same conditions of 20 minutes at 400°C.

Relatively small amounts of phosphorus compounds were evolved during the drying and curing steps of the THPC process. Considerably larger quantities of phosphorus compounds were removed in the washing step. Approximately 0.0003 and 0.0002% of phosphine-phosphorus, respectively, were found for the drying and curing steps on the basis of washed, cured fabric weight.

A large percentage of the total phosphorus present in the THPC-treated and phosphorylated fabric remained in the fabrics after charring. Most of the phosphorus which volatilized was in the form of easily condensable phosphorus compounds. A small amount of phosphine (0.0019%, based on fabric weight) was evolved when THPC-treated fabric was charred under the experimental conditions employed, whereas little or none was evolved from phosphorylated fabric.

ACKNOWLEDGMENT

The authors wish to express their appreciation to John D Guthrie and Wilson A Reeves for supplying the fabric samples used in this investigation, and for their many helpful suggestions during the course of the work.

LITERATURE CITED

(1) Beyer, K, Z *anorg u allgem Chem* 250, 312-20 (1943).

(2) Ford, F M, and Hall, W P (to Joseph Bancroft & Sons Co) U S Patent 2,482,755 (Sept 27, 1949).

(3) Mellor, J W, "A Comprehensive Treatise on Inorganic and Theoretical Chemistry", vol 8, 802-822, Longmans, Green and Co (New York), 1931.

(4) Pons, W A, Jr, and Guthrie, J D, *Ind Eng Chem* Anal Ed 18, 184-186 (1946).

(5) Pons, W A, Jr, Stansbury, M F, and Hoffpauir, C L, *J Assoc Offic Agr Chemists* 36, 492-504 (1953).

(6) Reeves, W A, and Guthrie, J D, "Imparting Flame-Resistance to Cotton by the Use of THPC-Resins", U S Agr Res Service, South Util Res Br, AIC-364, 12 pp Processed, Nov 2, 1953 (Revised May 11, 1954).

(7) Reeves, W A, and Guthrie, J D, *Textile World* 104, No. 2, 101, 176, 178, 180, 182 (1954).

(8) Guthrie, J D, Drake, G L, Jr, and Reeves, W, *Am Dyestuff Reptr* 44, No. 10, P328-32 (1955).

(9) Sax, N I, "Handbook of Dangerous Materials", 506, Reinhold Publishing Co (New York), 1951.

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Rotproofing and Weathering

(concluded from page 651)

give copper hydroxide in a manner similar to that noted with copper naphthenate (7). The association of the copper in inorganic form, thus produced, with the chromium oxide in the fabric may provide a basis for complex formation between those two compounds substantially similar to that which appears to take place on cotton fabric in which a mixture of the two compounds has been precipitated in a double decomposition reaction involving successive treatment of the fabric with a mixture of inorganic chromium and copper salts and with dilute alkali *(3)*.

CONCLUSIONS

The complex copper and zinc derivatives of dehydroabietylamine examined have been found to undergo loss of metal in weathering of the same order as copper naphthenate and solubilized copper 8-hydroxyquinolinolate or zinc naphthenate and zinc dimethyl dithiocarbamate. The dehydroabietylamine pentachlorophenoxide compound is completely removed on weathering. Said compounds do not show any evidence of causing enhanced actinic degradation in cotton duck.

When used as an aftertreatment on mineral-dyed duck, the effect of the chromium oxide in reducing loss of copper and reducing the extent of actinic degradation is maintained to a satisfactory degree.

The compounds show a relatively high capacity to protect cotton duck from microbiological attack, as judged by the soil-burial test. The copper complex shows a fungicidal effect intermediate between that of copper naphthenate and solubilized copper 8-hydroxyquinolinolate. The zinc complex shows a surprisingly high level of fungicidal action, and it should be regarded as an important addition to the hitherto rather limited number of colorless textile fungicides. The pentachlorophenoxide compound provides good protection over the range studied.

ACKNOWLEDGMENTS

The authors wish to acknowledge with thanks the assistance given by George R Barker, formerly of this laboratory, and by F W Baker, meteorological observer, Central Experimental Farm, Department of Agriculture, Ottawa, for providing the weather data. They also thank the Scientific Oil Compounding Co, Hercules Powder Co, and Nuodex Products of Canada Ltd, who supplied the compounds used in this work, and the Defence Research Board, Department of National Defence, for financial assistance in this work.

BIBLIOGRAPHY

(1) Cuniffe, P W, and Farrow, F D, *J Textile Inst* 19, T169 (1928).

(2) Block, S S, *Ind Eng Chem* 41, 1783 (1949).

(3) Rose, G R F, and Bayley, C H, *Textile Research J* 24, 792 (1954).

(4) U S Patent Pending to Scientific Oil Compounding Co, Chicago, Ill.

(5) Bayley, C H, and Weatherburn, M W, *Can J Research* F.25, 209 (1947).

(6) Bayley, C H, and Weatherburn, M W, *ibid* F.25, 92 (1947).

(7) Bayley, C H, and Weatherburn, M W, *Am Dyestuff Reptr* 34, 457 (1945).

(8) U S Patents 2,561,379 and 2,561,380.

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When Developing Azoics Continuously... use an efficient rewetting agent in the naphtholating bath. This insures quick and uniform absorption of the developing liquor by the naphtholated fabric. Deceresol Q or AN are excellent for this purpose.

Accurate Shade Matching requires light of adequate intensity as well as proper quality, of course. Filters and diffusing panels of matching lights should be cleaned very frequently.

Vat Dyes Upgrade Tufted Rugs

When cotton and rayon tufted rugs first came on the market, the American housewife accepted them with great enthusiasm. They were exceptionally attractive in looks and price. However, to assure a continuing place for tufted rugs in home decor, a number of improvements were made. The tuft or pile now has some of the resilient qualities of wool; nylon is often added for increased strength and durability. And one of the most important improvements is in the dyes now used in better quality rugs.

In the beginning, ordinary direct dyes were used, because they were inexpensive and simple to apply. As the demand grew for a better quality product and faster colors, sunfast direct colors came into use. This answered the cry for light fastness, but washfastness was still a problem.

Many rug manufacturers solved this problem with vat dyes.

The dyeing with vat dyes is usually done in stock form, and requires the best dispersed types of vat dyes. Cyanamid's finely dispersed vat dyes have been found eminently suitable.

Our technicians' experience can be of practical help to you in dyeing textiles for tufting. Ask your Cyanamid representative for full particulars.

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Because of the extreme brilliance of these two yellows, you can obtain bright golden yellows by shading Calcoloid Printing Yellow GCP Paste with Calcosol Golden Yellow GKWP Double Paste, and shading Calcoloid Yellow GCD Paste with Calcosol Golden Orange 3G Paste. Further information and samples on request.

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POSITION WANTED: B. Sc. in Textile Chemistry. Age 30. Two years' experience in a dying, printing and finishing plant as chemist. Desires position of or leading to technical sales and service. Write Box No. 972.

POSITION WANTED: Textile chemist, age 31, experienced dyeing and finishing plant and development of textile chemicals. Desires opportunity in sales work. Write Box No. 973.

POSITION WANTED: PRINT SUPERVISOR-COLORIST. Extensive experience on MACHINE and SCREEN printing of cottons, rayons and synthetics. Proven ability taking charge of printing and color-shop departments. Age 42. Write Box No. 945.

POSITION WANTED: Dyer-Chemist-Manager, college graduate. Interested in quality and production control, liaison. Good theoretical and practical background in most phases of textile processing. Diversified mill and laboratory experience. Strong supervisory experience. References, relocate. Write Box No. 967.

WANTED: OPPORTUNITY DESIRED for utilizing the knowledge and proven experience of 24 years in bleaching, dyeing, and mechanical and chemical shrinkage control elements of the textile industry. At the age of 41, offer a background of both production and executive accomplishments. Experience on natural and synthetic tubular textiles. Possess basic knowledge of the industry as a whole. Write Box No. 965.

POSITION WANTED: As chemist, dyer, or in quality control, by graduate chemist experienced as laboratory director, dyer, finisher, and quality control head with full range of synthetic fibers. Northern New Jersey or metropolitan area preferred. Write Box No. 955.

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POSITION WANTED: DYER-SUPERVISOR of jig plant specializing in fast colors on cotton and rayon piece goods. Experience includes jig and pad application of vats, napthols, sulphurs, developed, after-treated direct colors, resins, starches, waterproofing and flameproofing. Position desired by this young man, who is a graduate chemist with an excellent technical background, must have a future. Write Box No. 974.

WANTED: Dyer chemist with 2 to 5 years experience in dyeing woolens and woolen blends. Laboratory development work, with possibility of some travel later. Southeastern location. Salary open, depending on qualifications. Write Box No. 975.

SALESMEN TRAINEES: Important dyestuff company invites applications from young men with good education to be trained for a selling career with bright prospects. Experience in dyeing is an advantage but not essential. Submit details in own handwriting. Write Box No. 976.

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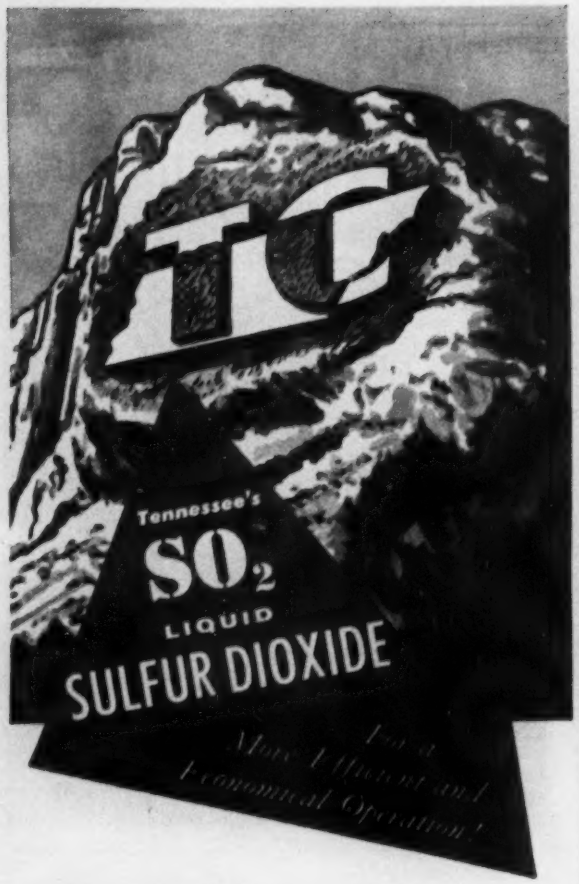

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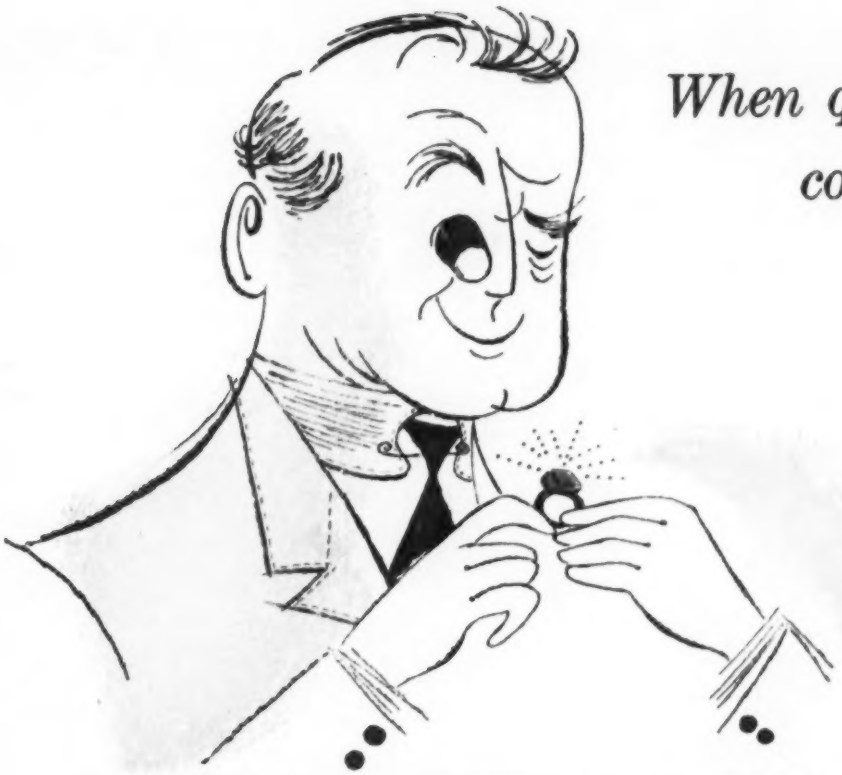

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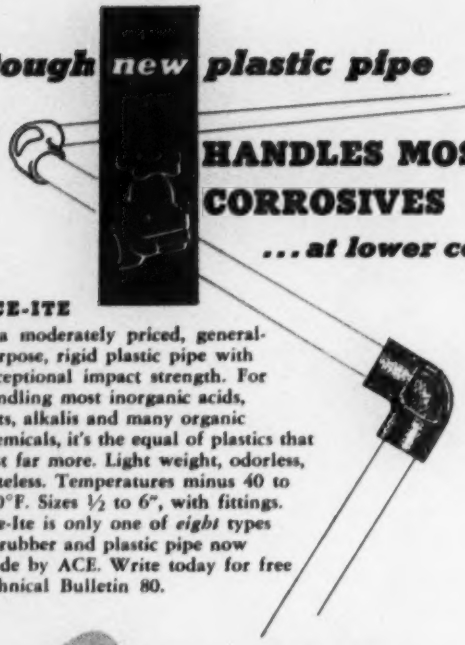

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